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WAR MACHINE

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U.S. AIR FORCE

Armed Forces of the World: The Netherlands (Part 2)

US Jet Designs

Strategic Air Command

Britain's V-bombers

A fully illustrated guide to the world's post-war bombers

WAR MACHINE

Volume 2 **Issue 17**

CONTENTS

Post-war Bombers

Boeing B-29/B-50 and Tupolev Tu-4 322
Convair B-36 Peacemaker 323
North American B-45 Tornado 323
US Jet Designs 324
Boeing B-47 Stratojet 324
Martin B-57 Canberra 326
Convair B-58 Hustler 326
Strategic Air Command 327
Boeing B-52 Stratofortress 328
Boeing B-52 in Action 329
BAe (English Electric/BAC) Canberra 334
Avro Lincoln 335
Vickers Valiant 335
British Aerospace (Avro/Hawker Siddeley) Vulcan 336
Britain's V-bombers 337
Handley Page Victor 338
Sud-Aviation Vautour 338
Ilyushin Il-28 'Beagle' 339
Myasishchyev M-4 'Bison' 339
Tupolev Tu-16 'Badger' 340
Tupolev Tu-95/Tu-142 'Bear' 340

Armed Forces of the World

The Netherlands (Part 2) iii

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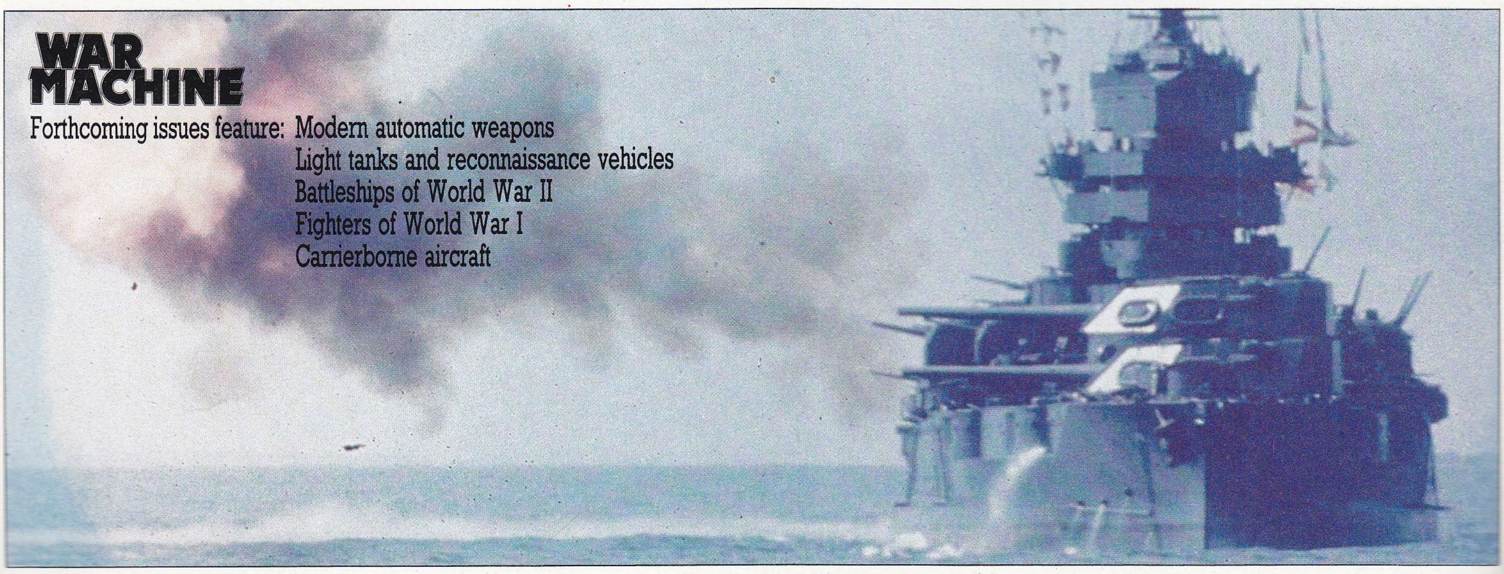
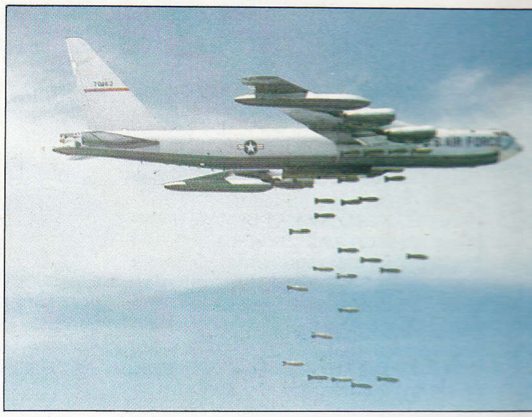


WAR MACHINE

Forthcoming issues feature: Modern automatic weapons
Light tanks and reconnaissance vehicles
Battleships of World War II
Fighters of World War I
Carrierborne aircraft

Post-war Bombers

Since the end of World War II, the bomber has undergone rapid transformation from piston-engined free-fall bomber to supersonic high-performance aircraft carrying nuclear stand-off weapons. Here we describe the bombers of the three decades after the war from the Avro Lincoln to the Convair B-58, and the actions they have taken part in, culminating in the massive raids on Vietnam.



The bomber at its mightiest: 51 750-lb (340-kg) bombs rain down from a Boeing B-52F on Viet Cong positions during the early days of the campaign. Later, Vietnam B-52s received camouflage.

At the start of World War II a bomber carried a load containing perhaps one ton of high explosive, enough to demolish several houses. (But most bombs fell on open ground, and in night attacks most crews failed to find the target anyway.) By the end of that conflict a bomber could drop a bomb containing the equivalent of 20,000 tons of high explosive, enough to demolish a city.

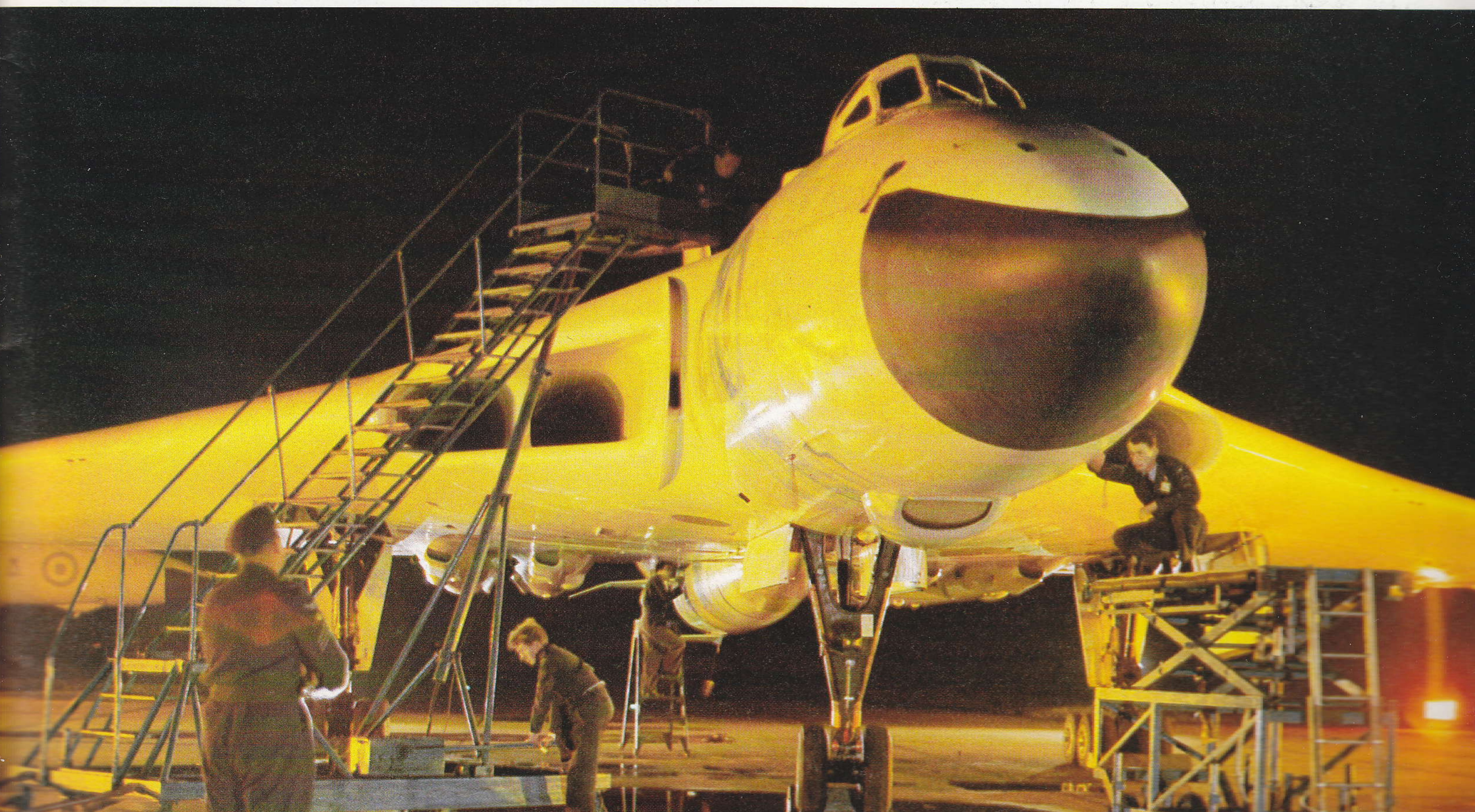
As if this were not enough of a revolution in attack capability, jet propulsion, which was applied first to fighters, was soon adopted for new bombers. At a stroke this doubled the speed and the over-target height of the coming generation of jet bombers compared with their piston-engine predecessors, so rendering almost obsolete most conventional anti-aircraft defences, with the sole exception of the new jet fighters. Ordinary AA guns could not fire high enough, and in any case the speed of jet bombers posed timing problems which could not be met by traditional methods of defence, using reports channelled in to defence centres with model aircraft pushed about on large plotting tables while senior officers studied the situation and took decisions.

Of course, the proven long-range bomber designs were not scrapped overnight. The pioneer Boeing B-29 was developed into the B-50 in the USA and into the Tupolev Tu-85 in the Soviet Union, the Avro Lancaster into the Lincoln (which was frankly outmoded in concept by the time it appeared), and the enormous Convair B-36 was continued after the war and eventually put into service as the first bomber with global capability.

The UK's first jet bomber, the English Electric Canberra, appeared very pedestrian in comparison with such dramatic machines as the Boeing B-47 and Boeing B-52, but in fact it was for a time almost a replacement for the wartime de Havilland Mosquito in being very difficult to intercept. Thanks to its large wing it could fly very high and pull tight turns, and early jet fighters such as the Gloster Meteor and de Havilland Vampire were outclassed by it. In contrast the B-47 went to the opposite extreme with a swept wing only slightly larger in area despite the fact that the laden weight, compared with that of the Canberra, was four times heavier! Thus the B-47 was an unforgiving aircraft, but at the same time it showed the world how not only bombers but also civil jetliners would be designed in the future.

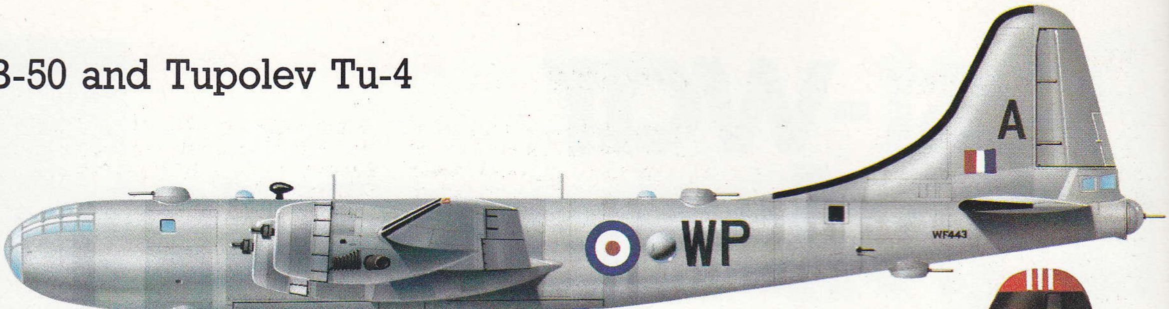
During the introduction of jet propulsion there was much argument about how the new breed of high-speed aircraft should be designed. Swept wings were soon shown to postpone the sudden rise in drag as the speed of sound was approached, but some designers studied tailless or tail-first layouts, while others liked the large wing area and low structure weight of the triangular delta. In the event only one subsonic delta bomber was built, the Avro Vulcan; but this was so successful it remained in service until 1984. Later the same wing-plan was adopted for the Convair B-58, but with a very thin profile and stainless-steel structure for flight at Mach 2 (twice the speed of sound). In parallel, free-fall bombs were increasingly replaced by stand-off missiles able to navigate by themselves.

At the height of its career the Avro Vulcan carried Britain's nuclear deterrent in the form of the Blue Steel missile. Aircraft were on constant alert throughout the Cold War, in which the strategic bombers played out their ever-ready role.

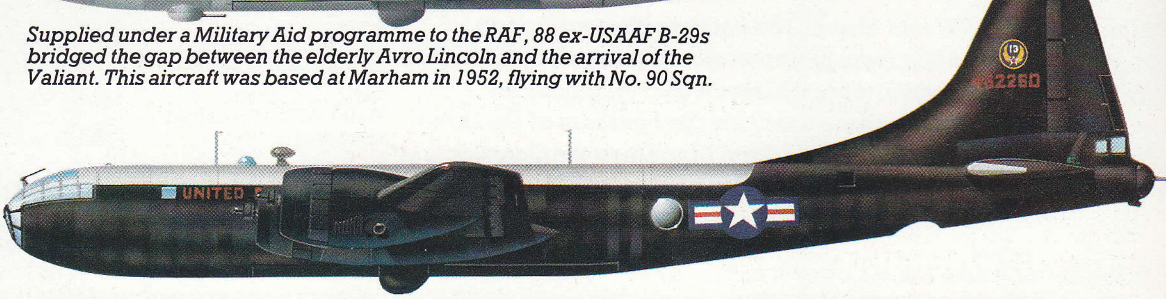


USA/USSR

Boeing B-29/B-50 and Tupolev Tu-4



Supplied under a Military Aid programme to the RAF, 88 ex-USAAF B-29s bridged the gap between the elderly Avro Lincoln and the arrival of the Valiant. This aircraft was based at Marham in 1952, flying with No. 90 Sqn.



Although mainly used as a level bomber, some B-29s in Korea were used on clandestine missions over Manchuria. B-29A 44-62260 was one such aircraft.

Planned in 1938, at a time when the US Congress was refusing funds for the previous-generation B-17, the **Boeing B-29** was by far the most advanced aircraft of any kind in its era, which was World War II. In its structural loads, skin thickness, remote-control armament, pressurized crew cabins and certainly in its range with a heavy bombload, the B-29 was in a class by itself. The prototype flew in September 1942, and thanks to a gigantic nationwide building programme more than 2,000 got into action against Japan, operating from bases in China and later the newly taken Marianas Islands with the specially formed 20th Air Force. The first mission was from India against Bangkok on 5 June 1944, but the big attacks came after 24 November 1944 from the Marianas, building up to giant raids involving over 300 aircraft, which from 9 March 1945 used a new technique: bombing in a loose stream, by night, from low level, using incendiaries. These tactics gutted Japan's cities, and two raids with 20-kiloton nuclear bombs, on 6 and 9 August 1945, forced Japan to surrender and so ended World War II. Boeing built 3,960 B-29s, followed by several hundred of many versions of the **B-50**, with more powerful engines and other changes. Curiously, these saw action only as tankers in the Vietnam War, but B-29s operated throughout the Korean War, the 22nd and 92nd Bomb Groups opening strategic missions as early as 13 July 1950. Though never more than 99 B-29s were on strength, the two groups flew 21,000 sorties and dropped 167,100 tons, more than the tonnage dropped by B-29s in World War II. The ironic twist in the tail is that in 1944 the Soviet Union began trying to buy B-29s or design a copy. Then three B-29s force-landed in Soviet territory. They were dissected in minute detail, and the Tupolev design bureau built first a simple transport, the **Tu-70**, followed in July 1947 by the first **Tu-4** bomber. This was a B-29 except in having 23-mm cannon in its five twin turrets. About 400 were built, but they did not see action; their main importance was that they were the starting point for all today's Tupolev strategic turboprop and jet bombers.

Specification

Boeing B-29

Type: strategic bomber with crew of 10

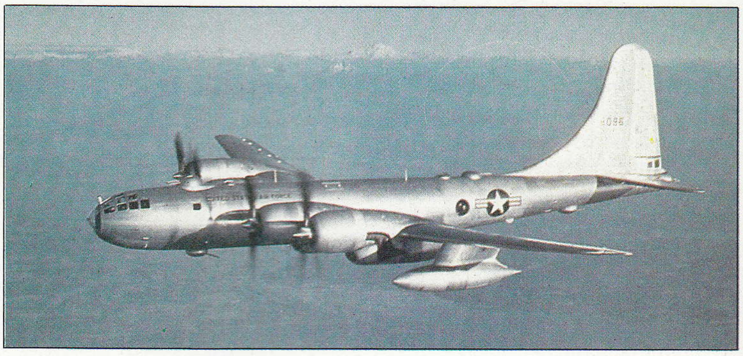
Powerplant: four 2,200-hp (1641-kW) Wright R-3350-57 (or related) Duplex Cyclone 18-cylinder radials

Performance: maximum speed 576 km/h (358 mph) at high altitudes; service ceiling 9750 m (32,000 ft); range with maximum bombload 5230 km (3,250 miles)

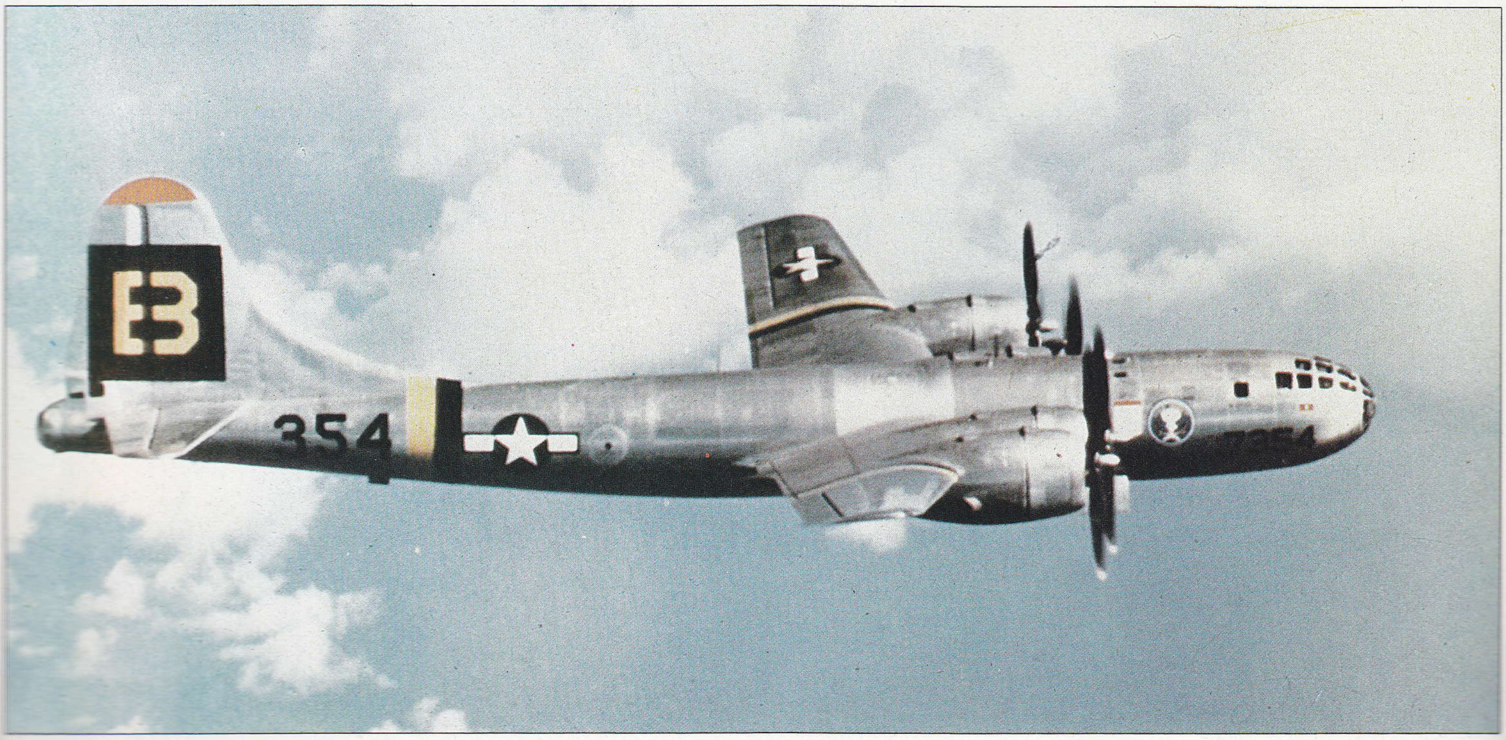
Weights: empty 31816 kg (70,140 lb); maximum take-off for B-29 56246 kg (124,000 lb) and B-29A and B-29B 64002 kg (141,100 lb)

Dimensions: span 43.05 m (141 ft 3 in); length 30.18 m (99 ft 0 in); height 9.02 m (29 ft 7 in); wing area 161.28 m^2 (1,736.0 sq ft)

Armament: bombload of 9072 kg (20,000 lb), plus 10 12.7-mm (0.5-in) machine-guns and one 20-mm cannon in five turrets



Above: Carrying the brunt of SAC's duties immediately after the war was the Boeing B-50. This was based on the B-29 but featured Wasp Major engines (with characteristic 'chin' air inlets) and a taller fin.



An important task for the B-29 immediately post-war was testing nuclear weapons. Here B-29-40-MO, 'Dave's Dream', heads for Bikini atoll to drop the first nuclear bomb after the war's end on 1 July 1946.

USA

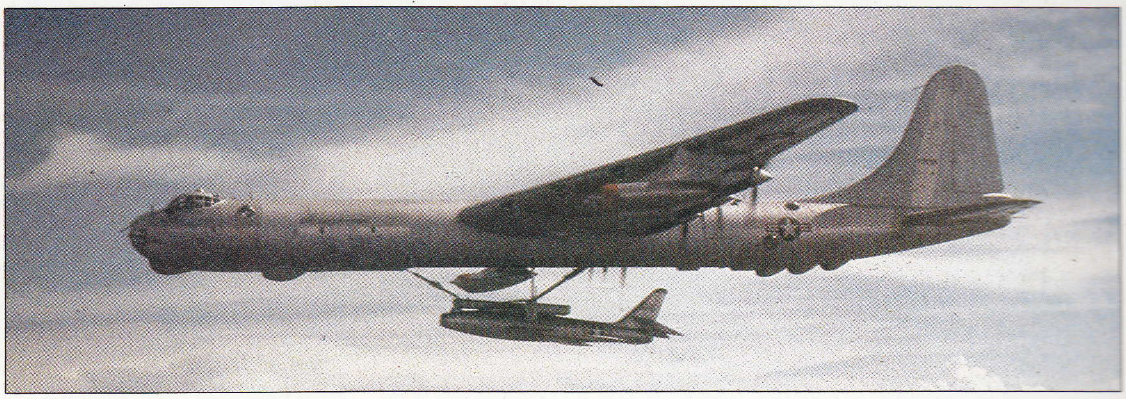
Convair B-36 Peacemaker

The largest-span aircraft ever made in quantity, the **Convair B-36 Peacemaker** was planned in 1941 as an ultra-long-range bomber able to attack Nazi Germany on round-trip missions from the United States if the UK were to collapse. The colossal design task was delayed by urgent pressure to develop the Consolidated B-24 and Consoliated B-32, but the prototype finally flew on 8 August 1946. Of unique configuration, the B-36 had six of the largest available engines mounted in the heart of the gigantic wing, fed by leading-edge inlets and driving enormous pusher propellers. The tubular fuselage housed a crew of 15 in pressurized compartments in the nose, aft of the wing and in the tail. A small truck carried crew along a pressurized tunnel linking the cabins, while pressurized tubes led engineers to the engine compartments. Deliveries to newly formed USAF Strategic Air Command began in late 1947, and eventually 385 of the monsters were built in many versions. From 1950 the over-target height and speed were boosted by adding four turbojets in pods under the outer wings with shutters to streamline the pods in cruising flight. Missions could last up to 50 hours without using the inflight-refuelling capability, and it was said crews tore pages off a calendar to keep track of missions. Complete wings were based in the UK, Morocco, Guam and other areas, as well as in the USA until February 1959. No missions were flown 'in anger'.

Specification

B-36J Peacemaker
Type: long-range super-heavy bomber
Powerplant: six 3,800-hp (2834-kW) Pratt & Whitney R-4360-53 Wasp Major 28-cylinder radial piston engines and four 2359-kg (5,200-lb) thrust General Electric J47-GE-19 turbojets
Performance: maximum speed 661 km/h (411 mph) at 11095 m (36,400 ft); over-target height up to 12160 m (39,900 ft); range with 4990-kg (11,000-lb) bombload 10944 km (6,800 miles)
Weights: empty 77581 kg (171,035 lb); maximum take-off 185976 kg (410,000 lb)
Dimensions: span 70.10 m (230 ft 0 in); length 49.40 m (162 ft 1 in); height 14.23 m (46 ft 8 in); wing area 443.3 m^2 (4,772.0 sq ft)
Armament: 16 cannon of 20-mm calibre in six retractable turrets and nose and tail turrets; bombload of up to 39010 kg (86,000 lb)

The GRB-36F was a reconnaissance version modified to carry a Republic F-84F fighter as a parasite for protection. Noticeable are the four underwing jets for added performance.



USA

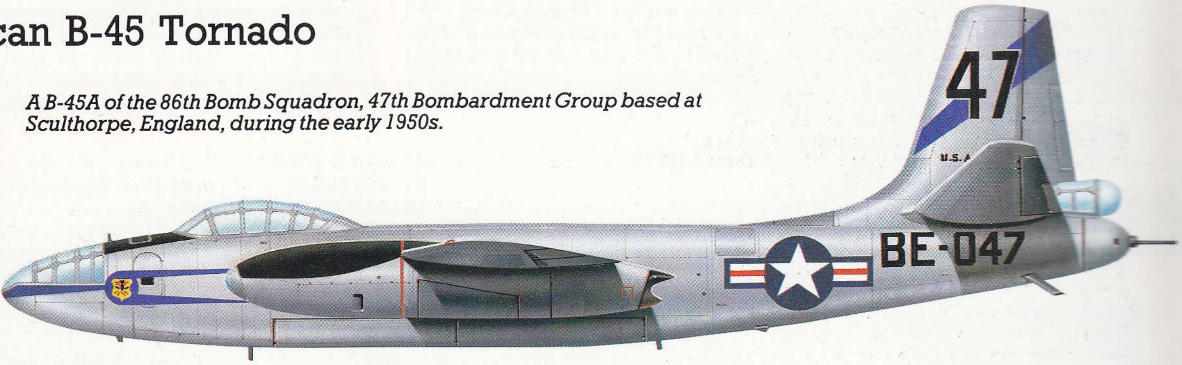
North American B-45 Tornado

The first jet bomber to go into production outside Germany, the **North American B-45 Tornado** was begun in 1943 and the design was frozen in early 1945. The first flight was on 17 March 1947, and in November 1948 the **B-45A** went into service with the 47th Bombardment Group of the USAF, later based in England. The design was generally conventional, though the main gears had very large single wheels which retracted sideways into the wing roots. In normal bomber versions the bomb-aimer/navigator occupied the capacious pressurized nose, the two pilots sitting in a tandem fighter-like cockpit farther aft and above, with a large multi-pane canopy. The crew door was on the left side of the forward fuselage. A gunner was housed in a pressurized tail compartment. Because of the better capability of the B-47 only 96 B-45As were built, plus 10 of the stronger and more powerful **B-45C** which was distinguished by large wingtip tanks. Many A-models were modified to B-45C standard. The final 33 aircraft were **RB-45C** camera aircraft, some of which (unlike the bomber versions) operated over Korea. Some had water injection tanks hung under the twin-engine nacelles, jettisoned after take-off. One squadron of B-45Cs operated from RAF airfields in British service markings, though remaining USAF property and with USAF crews. Details of how they were operated (presumably on intelligence missions) have never been disclosed. The last B-45s were withdrawn from combat duty in mid-1958.

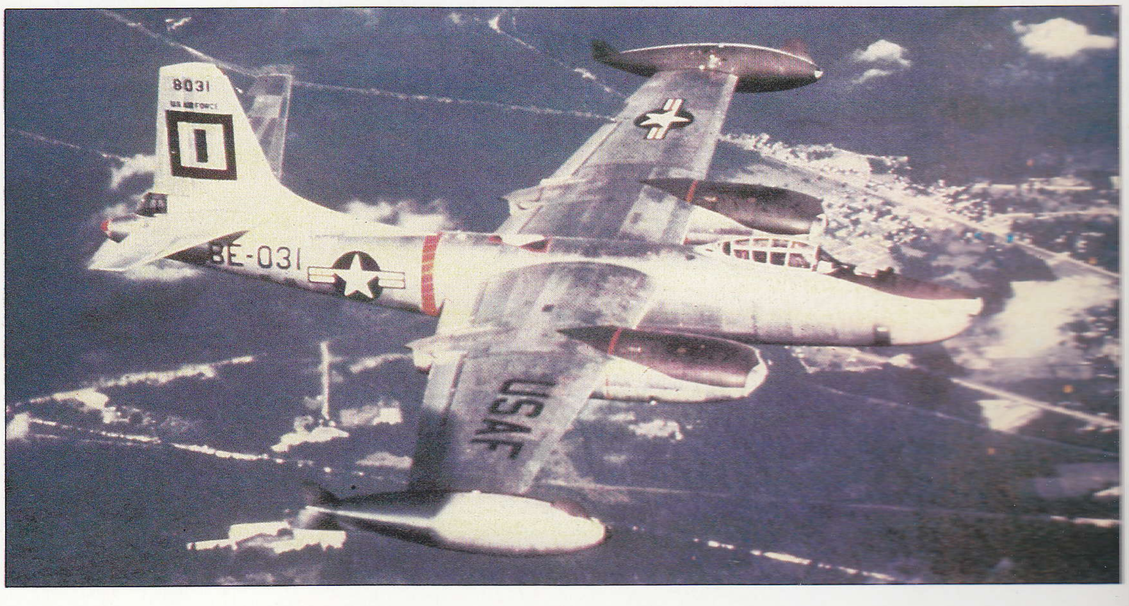
Specification

B-45C Tornado
Type: three-seat light tactical bomber
Powerplant: four 2359-kg (5,200-lb) thrust General Electric J47-GE-13/15 turbojets (some with water injection raising take-off thrust to 2722 kg/6,000 lb)
Performance: maximum speed 932 km/h (579 mph) at low level; service ceiling 13165 m (43,200 ft); range 3074 km (1,910 miles)
Weights: empty 22182 kg (48,903 lb); maximum take-off 51235 kg (112,952 lb)
Dimensions: span over tip tanks 29.26 m (96 ft 0 in); length 22.96 m (75 ft 4 in); height 7.68 m (25 ft 2 in); wing area 109.2 m^2 (1,175.0 sq ft)
Armament: two 12.7-mm (0.5-in) machine-guns in tail turret; internal bombload of up to 9979 kg (22,000 lb)

A B-45A of the 86th Bomb Squadron, 47th Bombardment Group based at Sculthorpe, England, during the early 1950s.



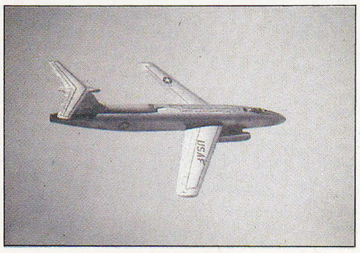
The North American B-45 was the first American four-jet bomber and saw good service in Europe. It was developed into the RB-45C reconnaissance version seen here, which saw action in Korea.



US Jet Designs

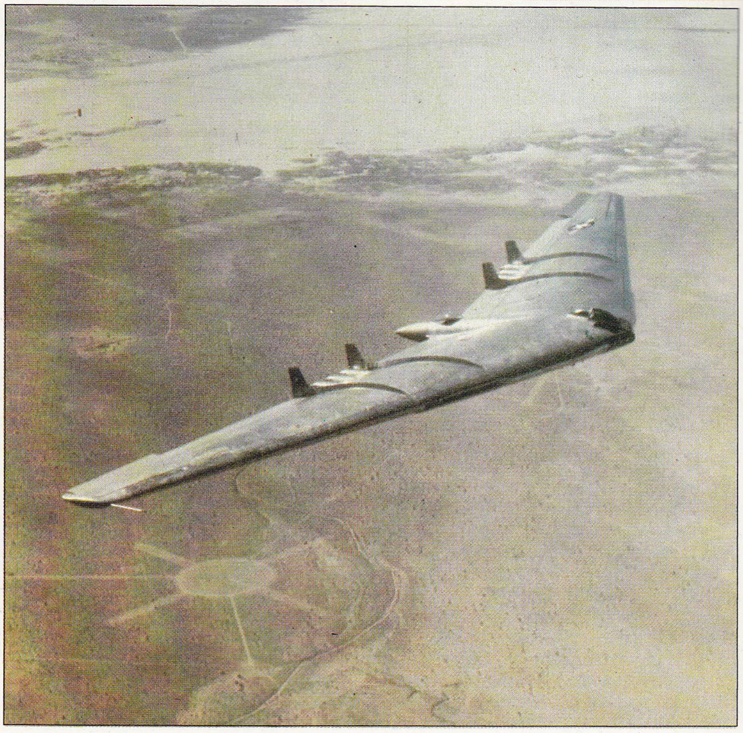
Throughout the post-war period, the leader in bomber design has been the United States, with many advanced projects on the drawing boards of the major companies. The ones that reached production stage went on to form the largest and most effective bomber force in history.

After Hitler's Germany, the pacemaker with jet bombers was the United States. First came the Douglas XB-43, a jet conversion of the very efficient XB-42 which had pusher propellers behind the tail. Then came three prototypes each with traditional aerodynamics but with the new axial turbojets hung under the wings: the North American XB-45, Convair XB-46 and Martin XB-48. Only the B-45 went ahead, named Tornado, and it gave many years'service to the USAF with a 9072-kg (20,000-lb) bombload or, in the RB-45 versions, a battery of cameras. Small numbers served in the UK on clandestine missions over the Iron Curtain borders, with USAF crews but in RAF markings. At the same time, in the 1950s,



Flying for the first time in October 1949, Martin's XB-51 featured a small swept-back wing and three turbojets; one mounted in the tail and the others mounted low on the fuselage sides in front of the leading edge. The Air Force preferred the British Canberra design and Martin built this as the B-57.

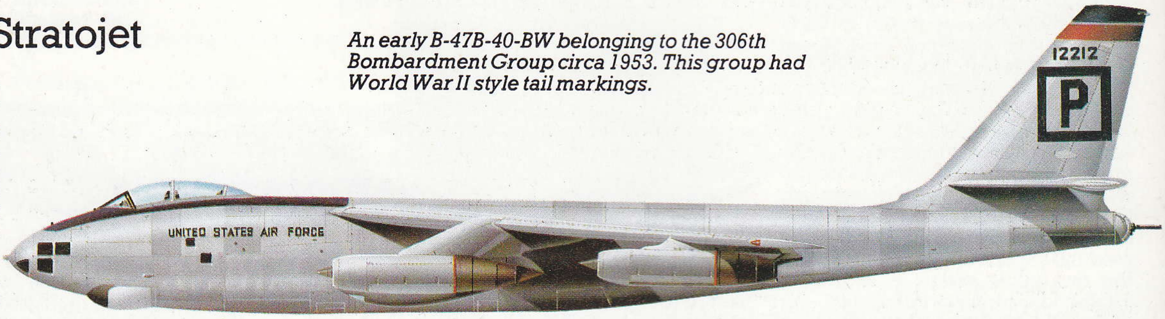
The Convair XB-46 was developed with the North American B-45 and Martin XB-48 soon after the war. All were conventional aircraft with the new axial turbojets mounted under the wings. The XB-46 had four General Electric TG-180s on its first flight in 1947 but only the B-45 saw USAF service.



A most dramatic US development was the Northrop YB-49. This was an eight-jet bomber developed from the earlier XB-35 four-piston-engined bomber. Despite good results in speed and range owing to the favourable aerodynamics of the 'flying wing' the project was cancelled.

USA

Boeing B-47 Stratojet



An early B-47B-40-BW belonging to the 306th Bombardment Group circa 1953. This group had World War II style tail markings.

When Boeing began to design the **Boeing B-47 Stratojet** jet bomber in 1943 it was very like a jet version of the B-29. The configuration changed several times and eventually the prototype was boldly given a wing and tail swept at 35° to postpone high-subsonic drag rise, with six jets in pylon-mounted pods. Another unusual feature was the bicycle landing gear. First flight was as early as 17 December 1947, and performance was dramatically better than prediction, with 25 per cent less drag. The only problem was that the very heavily loaded aircraft was difficult to fly, and at high altitude could get into 'coffin corner' where stalling speed and maximum speed were almost the same. Delivery of the **B-47A** began in December 1950, and these impressive machines introduced a new level of performance, complication and technology to military aviation. The tail guns were sighted from the nose, and the two pilots sat in a tandem fighter-like cockpit with access from a ventral door and stairway. Enormous fuel loads could be housed in the fuselage, and the **B-47B** and later models carried giant 5683-litre (1,500-US gal) drop tanks under the wings. Various rocket installations could boost the long take-off, and a large braking parachute helped arrest the landing. Despite the fuel capacity the range was too short for SAC's main global missions, but over 2,200 Stratojets were delivered, mainly of the **B-47E** type, and they operated from the UK, North Africa, Pacific islands and many other areas. Many were **RB-47** reconnaissance versions or **ERB-47** 'ferret' Elint (electronic intelligence) platforms.

U.S. AIR FORCE
2331
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A classic ground shot of the Boeing B-47. During the height of the Cold War these aircraft formed the mainstay of Strategic Air Command's huge bomber fleet. These operated from bases around the world and many were converted into reconnaissance and Elint aircraft, making many clandestine flights.

Specification

B-47E-II Stratojet

Type: three-seat medium bomber

Powerplant: six 2722-kg (6,000-lb) thrust General Electric J47-GE-25 or -25A turbojets (wet rating)

Performance: maximum speed 975 km/h (606 mph) at medium altitudes; service ceiling 12345 m (40,500 ft); range with bombload 6440 km (4,000 miles)

Weights: empty 36631 kg (80,756 lb); maximum take-off 104330 kg (230,000 lb)

Dimensions: span 35.36 m (116 ft 0 in); length 33.50 m (109 ft 10 in); height 8.51 m (27 ft 11 in); wing area 132.7 m^2 (1,428.0 sq ft)

Armament: two 20-mm guns in tail turret; internal bombload of 9072 kg (20,000 lb)

Early versions of the B-47 made dramatic take-offs using RATO (rocket-assisted take-off) equipment. However, the later, and major, version, the B-47E, did not employ this despite being cleared for an increased take-off weight of 104330 kg (230,000 lb). Braking parachutes were used to reduce the landing run.

SAC (USAF Strategic Air Command) boosted the sluggish performance of its gigantic Convair B-36 long-range bombers by adding four jets in pods under the outer wings, but these were shut off during most of each mission.

By far the most important of the early USAF jet bombers was the Boeing B-47. This was held back while German swept-wing research was applied, but it still flew before the end of 1947, years ahead of anything else like it. Powered by six jets in pods hung under its slim 35° swept wing, it carried a vast load of fuel in the beautifully streamlined fuselage as well as a 9072-kg (20,000-lb) bombload. The crew numbered just three, two of them in a tandem cockpit like that of a fighter. In the tail were two guns aimed by a remote-control system directed by radar. Rockets could be used to help take-offs at maximum weight, and in fact the B-47 was the hottest and most demanding military aircraft of its day. Well over 2,000 were built, and though they could not fly SAC's global missions they were the backbone of the command's giant bomber deterrent force from the early 1950s to the mid-1960s.

Boeing B-52

By far the most important US bomber was the Boeing B-52. Planned from the end of World War II, this was finally built with eight jets in four paired underwing pods, and its immense size and lifting power made it a legend from the start. At first there were five men in the nose compartment and a gunner in the tail, but the final versions brought the gunner up front with automatic aiming for the four 12.7-mm (0.5-in) machine-guns or single 20-mm 'Gatling' cannon tail armament. The weapon bay amidships could carry a 12247-kg (27,000-lb) bombload, but in the Vietnam war many B-52s were rebuilt to carry loads of some 31752 kg (70,000 lb) of conventional bombs. This was far from what the B-52 was designed to do, and life was made harder by switching to low-level operations from 1963, causing prolonged structural problems. Some versions carried the Quail decoy missile, while others carried a pair of large Hound Dog stand-off cruise missiles on wing pylons. The Skybolt air-dropped ballistic missile was cancelled, but later models are armed with the SRAM and ALCM stand-off missiles which greatly increase lethality and the number of targets that one B-52 can attack.

After a colossal development programme SAC also used the Convair B-58 supersonic bomber throughout the 1960s. About 100 were put into SAC service, of 116 built, carrying various free-fall bombs and pods, but they were withdrawn prematur

***Below:** With a total thrust of 84368 kg (186,000 lb), the North American XB-70A Valkyrie was the most powerful aircraft ever flown. Flying at Mach 3 for 11265 km (7,000 miles), the Valkyrie could carry both nuclear and conventional weapons. Minutes after this picture was taken, one of the chase aircraft collided with the tail and the aircraft crashed.*

U.S. AIR FORCE
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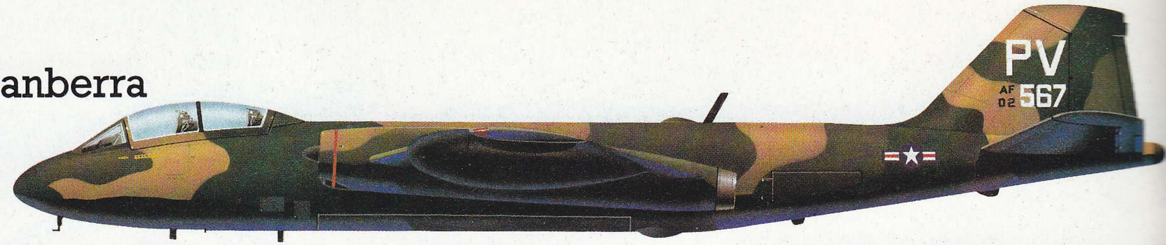
USA

Martin B-57 Canberra



52-1567 was a B-57B serving in Vietnam on interdiction duties. Note the divebrake on the rear fuselage.

In 1951 the British English Electric Canberra achieved the almost unique feat for a foreign aircraft of being adopted as a standard front-line combat type of the US Air Force. With the unrivalled combination of simplicity, easy servicing, good flight performance, amazing agility and the ability to deliver bombs accurately at all levels, it was just what was needed for the Korean War, and unlike other tactical jets it had plenty of range and endurance. Pattern aircraft were flown from the UK to the Glenn L. Martin works at Baltimore, crossing the North Atlantic nonstop in record time. The first **Martin B-57A** (the name Canberra was retained, though **Night Intruder** was also used) flew on 20 July 1953. This differed in many details from the British bomber, notably in having US-built Armstrong Whitworth Sapphire engines. The main model (202 built) was the **B-57B** with a redesigned forward fuselage with a crew of only two seated in tandem under a giant rear-hinged canopy. This attack version introduced a heavier bombload in a rotary-door weapon bay, plus eight pylons under the outer wings and forward-firing guns. The B-57B equipped two wings in Tactical Air Command and a wing of PACAF (Pacific Air Forces), but had mainly been passed to Air National Guard units by the early 1960s. Vietnam requirements then demanded aircraft in this class and all available B-57Bs (many had been rebuilt into other models) were rushed to South Vietnam and used very successfully in the attack role and in particular as FAC (Forward Air Control) aircraft. A total of 16 B-57Bs was rebuilt as **B-57G** (Tropic Moon) all-weather and night attack aircraft with APQ-139 radar, a FLIR (forward-looking infrared), low-light TV and laser ranger. The most capable aircraft of its day, the B-57G remained a mere study programme despite brilliant combat results. The last new-built version was the **B-57E** multi-role attack/bomber and target tug, all 68 of which were later modified for other tasks.

Specification

Boeing B-57B

Type: two-seat tactical attack bomber

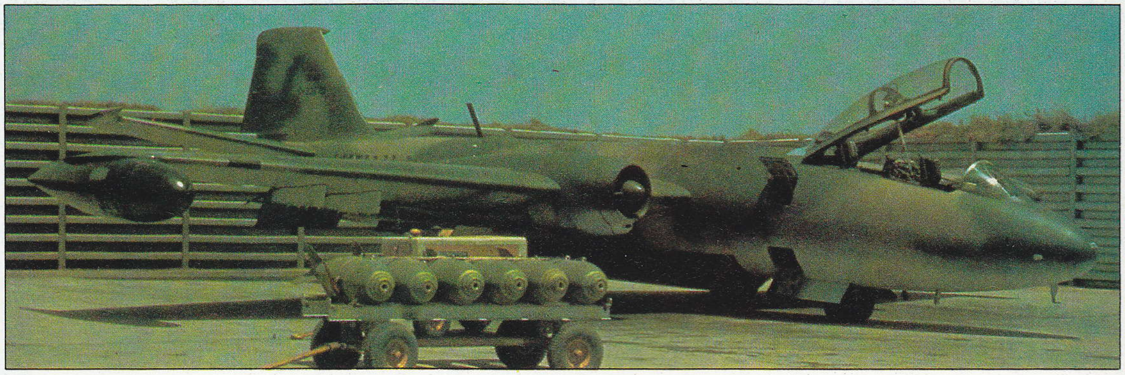
Powerplant: two 3,275-kg (7,220-lb) thrust Wright J65-W-5 turbojets

Performance: maximum speed 937 km/h (582 mph) at 12190 m (40,000 ft); service ceiling 14630 m (48,000 ft); range 3700 km (2,300 miles)

Weights: empty 11793 kg (26,000 lb); maximum take-off 24948 kg (55,000 lb)

Dimensions: span 19.51 m (64 ft 0 in); length 19.96 m (65 ft 6 in); height 4.75 m (15 ft 7 in); wing area 89.18 m^2 (960 sq ft)

Armament: eight 12.7-mm (0.5-in) or four 20-mm guns firing ahead; very varied offensive loads including up to 2722 kg (6,000 lb) in bomb bay, 16 underwing rockets or mixed rocket/bomb/napalm loads



Operating from Da Nang AB, this B-57 awaits its bombload. It proved efficient against guerrilla targets, and attrition was low.

USA

Convair B-58 Hustler

Design and development of the world's first supersonic bomber was one of the greatest challenges in the history of aviation. The prototype **Convair B-58 Hustler** flew in November 1956, and deliveries began three years later. Convair built 86 standard **B-58A** bombers, as well as 11 development aircraft later brought up to production standard and 17 **YB-58A** pre-production aircraft which were modified as **RB-58A** reconnaissance machines. Eight aircraft were converted into **TB-58A** trainers with a tandem pair of pilot stations. The regular bomber seated pilot, nav/bomb-aimer and defensive systems operator in tandem cockpits containing special escape capsules which, in emergency, could close around the occupant, seat and controls and be ejected as a sealed package. The basic concept of the B-58 was that of a tailless delta with an amazingly thin wing and no internal bomb bay, the payload comprising a giant pod hung under the centreline and containing either nuclear bombs, or one large weapon or a mixture of fuel and bombs. The TCP (two-component pod) consisted of a giant outer pod housing fuel which, after being consumed and jettisoned, revealed the smaller upper pod housing bombs, reconnaissance sensors or electronic warfare devices. These aircraft were extremely noisy, very demanding of their crews and packed with complex devices, but they were fantastic performers. The first SAC wing, the 43rd at Carswell AFB, set 19 world records including supersonic flights to or from London, Tokyo and Paris, as well as a perfect circle of 1609 km (1,000 miles) flown in under one hour to win a trophy unclaimed since 1909 when such a feat seemed pure science fiction. In 1970 the 43rd and its partner, the 305th Wing at Grissom AFB, were disbanded because of high operating cost.

Specification

Type: supersonic medium bomber

Powerplant: four 7076-kg (15,600-lb) thrust General Electric J79-GE-5A, -5B or -5C afterburning turbojets in complex variable pods

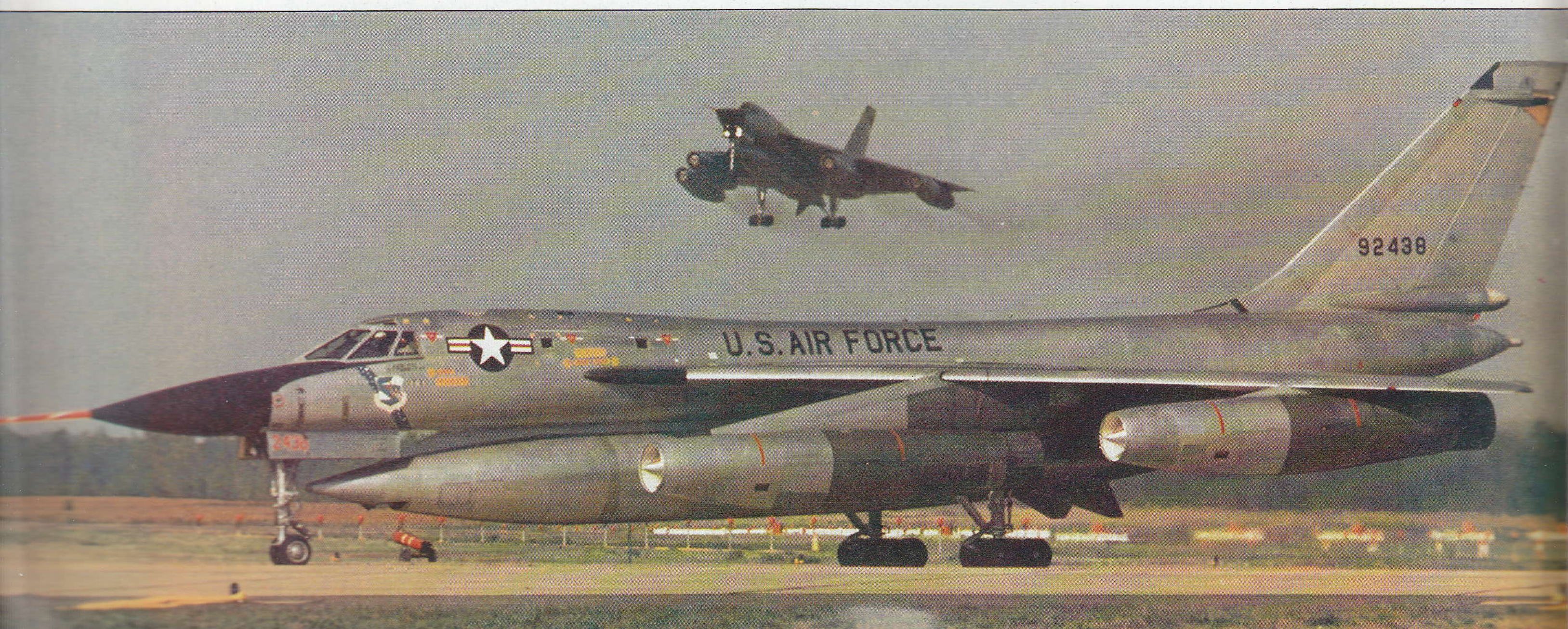
Performance: maximum speed at high altitude 2290 km/h (1,385 mph) or Mach 2.1; service ceiling 18290 m (60,000 ft); range without inflight-refuelling 8248 km (5,125 miles)

Weights: empty 25202 kg (55,560 lb); maximum take-off 73937 kg (163,000 lb) and after inflight-refuelling 80237 kg (176,890 lb)

Dimensions: span 17.3 m (56 ft 10 in); length 29.5 m (96 ft 9 in); height 9.58 m (31 ft 5 in); wing area 143.3 m^2 (1,542.0 sq ft)

Armament: one 20-mm six-barrel gun in tail; various mission pods to house bombs, or other mission loads

Seen at Carswell AFB, these B-58s are carrying the giant weapons and fuel pods. The four engines consumed fuel at an enormous rate.



Strategic Air Command

With a shift of emphasis to submarines and land-based ICBMs, SAC no longer carries alone the American deterrent flag, yet in the 1950s and 1960s this gigantic force held and maintained world peace in its grasp.

Before World War II the Soviet Union had large fleets of giant four-engine bombers while the USA had none. During that war the positions rapidly became reversed, and the USA built up by far the biggest long-range bomber force in history. The mighty Convair B-36, started in 1941 to bomb Germany from the USA, was continued as the first bomber with global striking power. A vast quantum jump in striking power came in 1945 with the atomic bomb, which was multiplied many times in 1952 by the thermonuclear or H-bomb.

It was against this background of immense change that the results of World War II's bombing campaigns were analysed. They showed that bombs delivered over great distances had played a major role in bringing about the collapse of the enemy countries. In the case of Japan the strategic bomber had shortened the war by at least a year and avoided the need for a gigantic and bloody invasion of the Japanese homeland. So instead of going back to an impractical pre-war isolation the US Army Air Force (soon to become the blue-uniformed US Air Force) formed Strategic Air Command on 21 March 1946.

Subsequently SAC grew to become the world's most powerful long-range bomber force. Starting with the Boeing B-29 and Boeing B-50, it received nearly all the 385 monster B-36 bombers, to be followed by 2,000 six-jet Boeing B-47s and the even more costly programmes for the 2090-km/h (1,300-mph) Convair B-58 and eight-jet subsonic Boeing B-52. What finally made SAC a giant force was the Russian isolation of Berlin in 1948. The airlift kept the city alive and free, but the only thing that kept the Soviet tanks outside it was the presence in Europe of three groups of SAC B-29s. The inescapable conclusion was that it was possible, by having enough strength, to deter aggression. Thus the motto of SAC became 'Peace is Our Profession'.

By 1960 technology had moved on to the North American B-70 Valkyrie, able to fly several hours at 3220 km/h (2,000 mph) or Mach 3, to the monster ICBMs (intercontinental ballistic missiles) headed by the Atlas and Titan, and to stand-off missiles such as the winged Hound Dog and the Skybolt air-launched ballistic missile. In turn the clumsy liquid-fuelled Atlas and Titan were replaced by the neater solid-fuel Minuteman, waiting at almost instant readiness in deep concrete silos proof against most kinds of enemy attack then considered possible. From 1962 SAC deployed 1,000 Minuteman ICBMs at remote bases in the American Midwest. It seemed SAC was set to deter war for ever, the only jarring note being the need to phase out high-altitude bomber missions and force the weary B-52s down to not much above treetop height because of the lethality of Soviet high-altitude SAM defences.

Since then shortage of money and new hardware has brought about a remarkable change in SAC's posture. The Valkyrie was cancelled, the B-58 withdrawn, and the once huge command has dwindled to a handful of ageing B-52s and Minuteman missiles in silos which are today vulnerable to Soviet attack by ICBMs of enormous size and pinpoint accuracy. At last under the Reagan administration plans are going ahead to deploy the Rockwell B-1B bomber and Peacekeeper

Reminiscent of the days of airborne alert during the Cold War, an SAC B-52 sets out from Andersen AFB on Guam to bomb North Vietnamese positions.

USA

Boeing B-52 Stratofortress

One of the largest and most powerful aircraft in history, the great **Boeing B-52 Stratofortress** is already a legend. Few aircraft produced under such urgent stress for a brief (planned eight years) period of combat duty have not only gone on to tackle many totally different, and far more demanding, missions, but have stayed in front-line duty for 30 years. When the B-52 (Model 464) was planned after World War II it was a turboprop, but by late 1948 the planned J57 turbojet opened the way to a great increase in speed without loss of range. Eight engines were installed in twin pods hung under the giant 35°-swept wing, and other unusual features included a vertical tail able to fold sideways to enter a hangar, wingtips that moved downwards 2.5 m (8 ft) as the wing tanks were filled, and four twin-wheel landing trucks which can be swivelled for cross-wind landings. The B-52 prototypes flew in 1952 and service with SAC began in 1955. Early versions had engines of below 4536-kg (10,000-lb) thrust and five crew in the nose, the gunner riding backwards in the tail. By 1958 weight had increased, engines were rated at 5080- or 6124-kg (11,200- or 13,500-lb) thrust with water injection, and new nav/bombing systems were fitted. By 1959 production switched to the **B-52G**, with a great increase in fuel capacity, the entire crew in the nose, a new structure with a short fin, and pylons for two Hound Dog missiles. The last of 102 **B-52H** bombers was delivered in 1963, bringing production to 744. The B-52H has the much more powerful TF33 engine, eliminating water injection, and instead of four 12.7-mm (0.5-in) tail guns has a six-barrel cannon. In Vietnam many earlier **B-52D** and **B-52F** aircraft were rebuilt to carry enormous loads of conventional bombs. Surviving B-52Gs and B-52Hs are continually being fitted with updated systems for service into the second half of the 1980s.

A B-52D departs from Guam. Carrying bombs and fuel, the aircraft needs full water-injection to lift it from the runway and a long, low climb can be expected.

Specification

B-52H Stratofortress

Type: long-range heavy bomber

Powerplant: eight 7711-kg (17,000-lb) thrust Pratt & Whitney TF33-P-1 turbofans

Performance: maximum speed 1011 km/h (628 mph); combat ceiling 14326 m (47,000 ft); range at high altitude with bombload 16300 km (10,130 miles)

Weights: empty 88450 kg (195,000 lb); maximum take-off 229068 kg (505,000 lb) and after inflight-refuelling 256738 kg (566,000 lb)

Dimensions: span 56.39 m (185 ft 0 in); length (as modified) 49.05 m (160 ft 11 in); height 12.4 m (40 ft 8 in); wing area 371.6 m^2 (4,000.0 sq ft)

Armament: T-171 20-mm tail gun; bombload of 8 nuclear free-fall or 20 AGM-69 SRAM missiles (later to carry 20 AGM-86B ALCM or Advanced Cruise Missiles)

B-52Gs are still active, though looking rather tired after something like 12,000 flying hours. When carrying cruise missiles, the aircraft has a change of wing shape for Soviet identification.

Boeing B-52 in Action

Planned from the end of the war, the B-52 has secured itself a place in aviation history, not only for its awesome size and power, but also for the massive raids on North Vietnam during the South East Asian conflict.

Boeing built the B-52 Stratofortress to fly in the high stratosphere and drop one or two nuclear bombs on enemy cities. The B-52 entered service with Strategic Air Command (SAC) in 1956 and soon demonstrated its tremendous capability by global missions, including a formation flight round the world by three 93rd BW aircraft from Castle AFB in 45 hours. By 1958 the Hound Dog stand-off missile was being added, with 1125-km (700-mile) range, as well as the Quail active countermeasures decoy RPV, three of which could be released from one of the bomb bays to look just like extra B-52s on enemy radars. The Skybolt ALBM (air-launched ballistic missile) was cancelled, but in 1972 the final B-52 models, the super-long-range B-52G and B-52H, became operational with up to 20 SRAMs (short-range attack missiles) each with a range up to 170 km (105 miles) at speeds around Mach 3. In 1981 B-52G squadrons began to be equipped with the AGM-86B ALCM (air-launched cruise missile), which carries a W-80 thermonuclear warhead up to 2500 km (1,550 miles). The next generation will be the advanced cruise missile, for which General Dynamics is prime contractor, but this may be carried only by the next-generation bomber, the Rockwell B-1B.

From 1963 the B-52 was forced into an environment utterly unlike that for which it was designed. The development of deadly SAM (surface-to-air missile) systems forced it to come down to the lowest possible level, typically at below 300 m (1,000 ft) above ground level. Here the strains and stresses on the wings and other parts are far greater than at the planned height of 12190 m (40,000 ft), and because of constant turbulence the ride is rough and the structure (and crew) soon suffer from fatigue. Every B-52 has had to be subjected to repeated and costly strengthening. Moreover, the low-level mission burns fuel roughly three times faster than the high-altitude mission, so ranges are reduced and reliance on inflight-refuelling tankers is increased. Not only that, but in the early 1960s the Cold War was so intense that B-52s were kept flying round the clock on 'airborne alert', so that they should not be destroyed in a missile attack on their air bases.

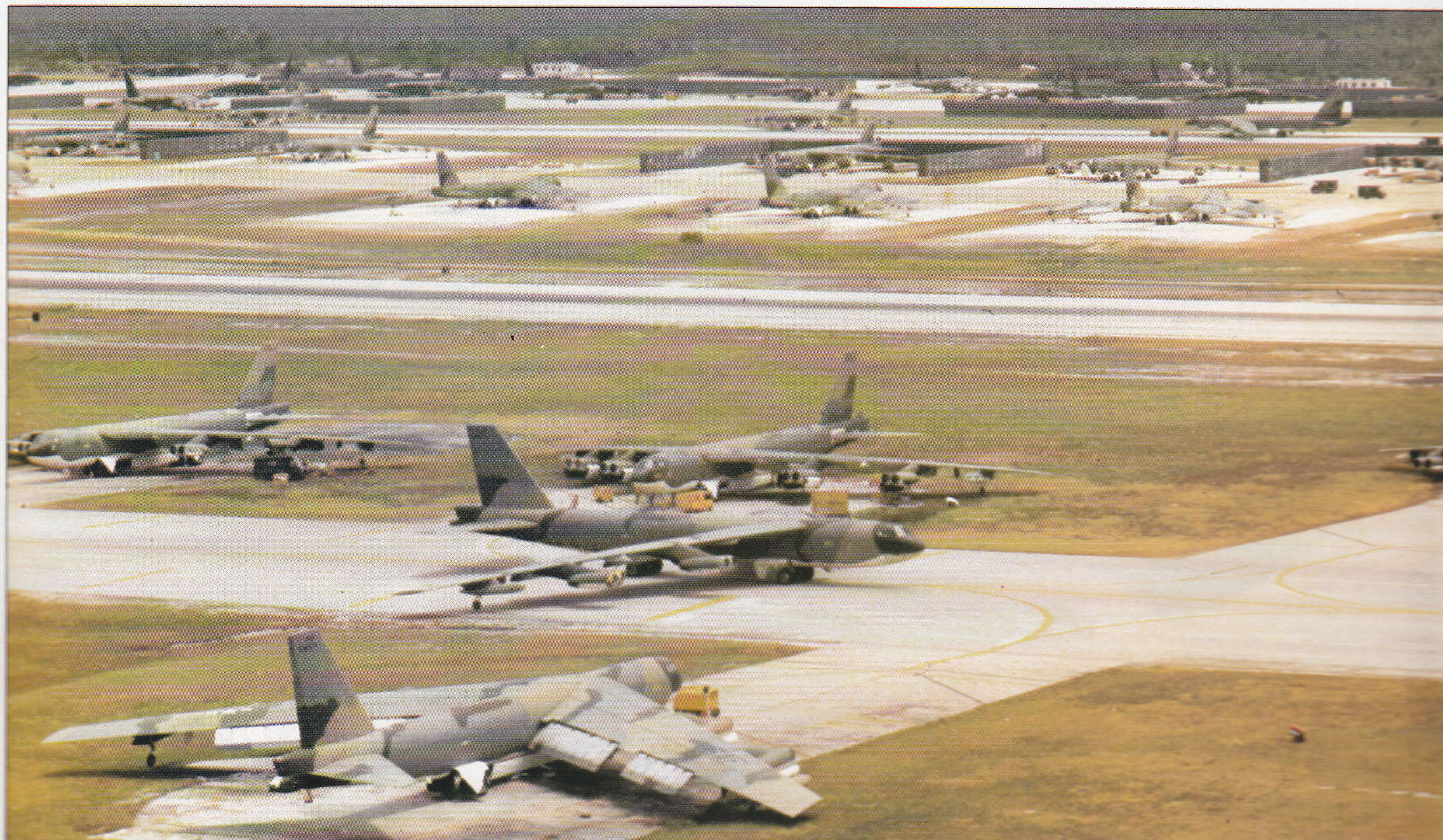
South East Asia

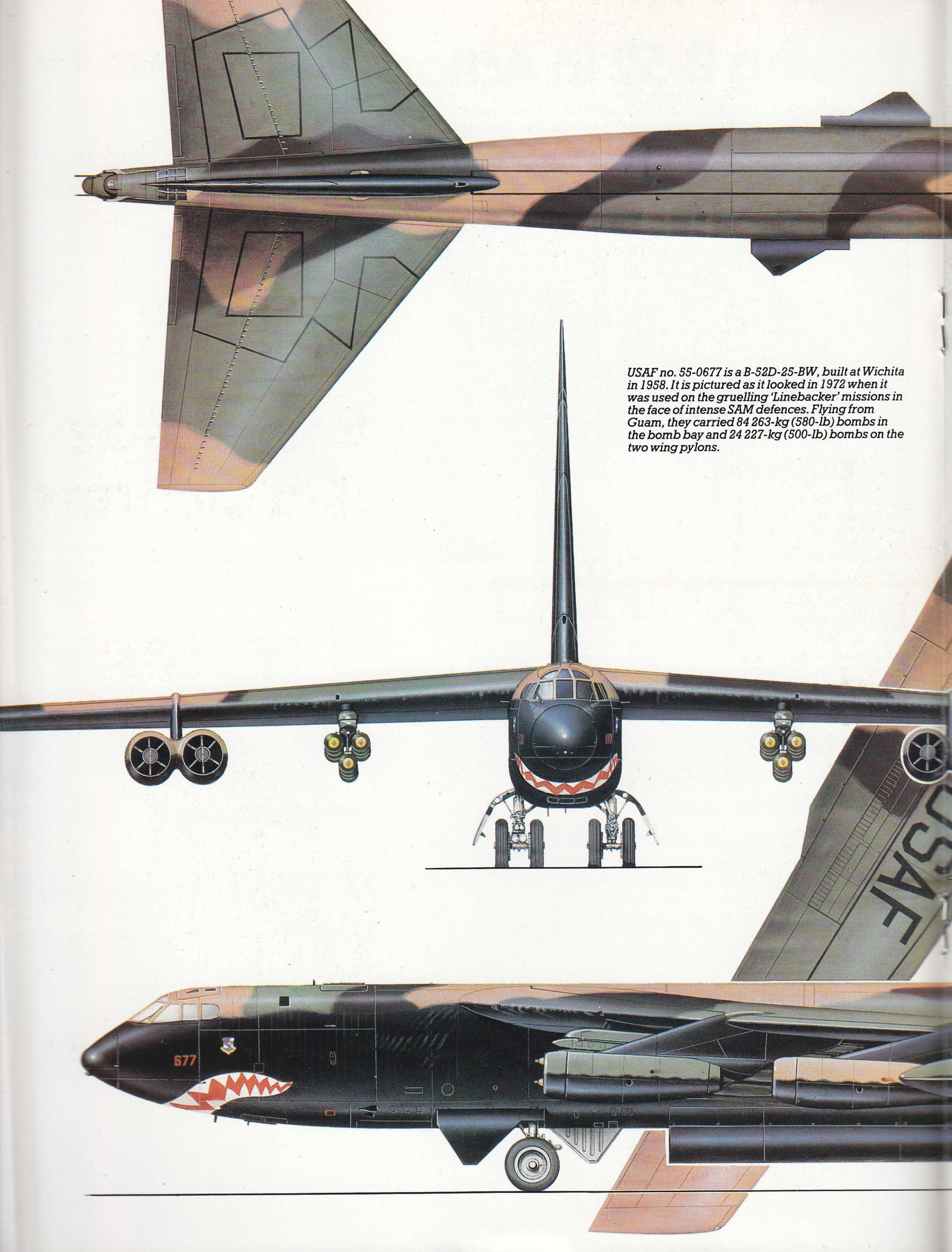
In the war in South East Asia in 1963-73 the B-52 was used in a prolonged campaign of heavy bombing using free-fall 'iron bombs', like those of earlier wars. Large numbers, including nearly all of the B-52D version, were modified to carry far greater loads than the original 12247 kg (27,000 lb) of HE bombs. The 'Big Belly' rebuild enabled the internal bay to be laden with 84 bombs each of 263 kg (580 lb), while the inner wings were fitted with large pylons with long rails for four tandem triplets of '750-lb' bombs each weighing 374 kg (825 lb), making a total load of some 31752 kg (70,000 lb). Thus burdened, B-52s took off from the slimy algae-coated switchback runway on Guam island, with a sheer coral cliff at the end, and flew gruelling 10-hour missions to rain down bombs on solid green forest where Viet Cong troops were thought to be hiding. To make life even tougher there were usually more B-52s based at Guam than the number of available parking spots, so all round the clock some aircraft had to be airborne.

The versions used in the war in South East Asia were the B-52D and B-52F, both distinguished from later types by their tall fins and giant underwing tanks. The B-52F model used engine-driven electric generators and hydraulic pumps, which resulted in bulges on the engine pods. This gave slightly better range than the previous arrangement using accessories driven by high-speed turbines fed with 'red hot' compressed air ducted in stainless-steel pipes, and also removed a minor hazard because the turbos could explode if hit by flak splinters. On the whole the giant bombers, always called BUFFS – from the initials of (in an expurgated version) Big Ugly Fat Fellers – by their crews, stood up well to their gruelling missions and to the increasingly strong North Vietnam defences.

Towards the end of the war the more modern B-52G was also deployed to Guam and Thailand, this variant being distinguished by an integral tank 'wet wing', a short fin and totally different crew compartment and systems. In many ways they were better bombers, but they had not been rebuilt for conventional warfare and carried much smaller loads, typically 27 bombs of 340-kg (750-lb) size. In the final phase of the air war, called 'Linebacker II', the mixed B-52D and B-52G forces flew from the two bases, Andersen on Guam and U-Tapao in Thailand, to rain down bombs on strategic targets in North Vietnam. 'Linebacker II' began on 18 December 1972 and finished on 15 January 1973. A total of 729 sorties was flown, causing colossal damage, but the defences were strong and well supplied with SAMs, which were fired at the rate of about 100 on each daily raid. Many B-52 crews counted 18 to 22 missiles on a single mission, and the results would have

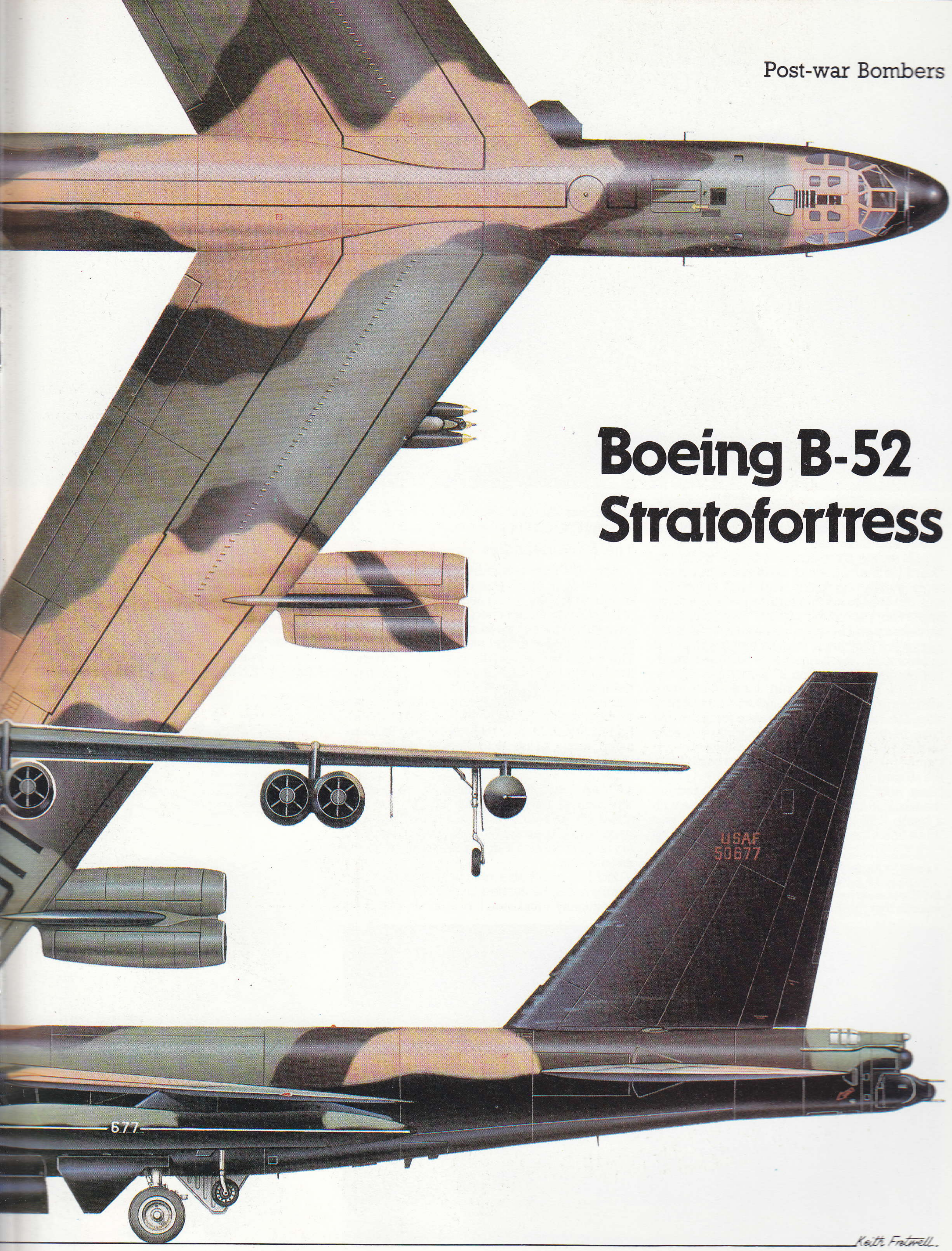
During the height of the Vietnam bombing campaigns, Andersen AFB on Guam had so many B-52s based there that a percentage of the force had to be airborne at any time. In this area alone there are 31 visible (G models in the foreground, D models in the background).





USAF no. 55-0677 is a B-52D-25-BW, built at Wichita in 1958. It is pictured as it looked in 1972 when it was used on the gruelling 'Linebacker' missions in the face of intense SAM defences. Flying from Guam, they carried 84 263-kg (580-lb) bombs in the bomb bay and 24 227-kg (500-lb) bombs on the two wing pylons.

Boeing B-52 Stratofortress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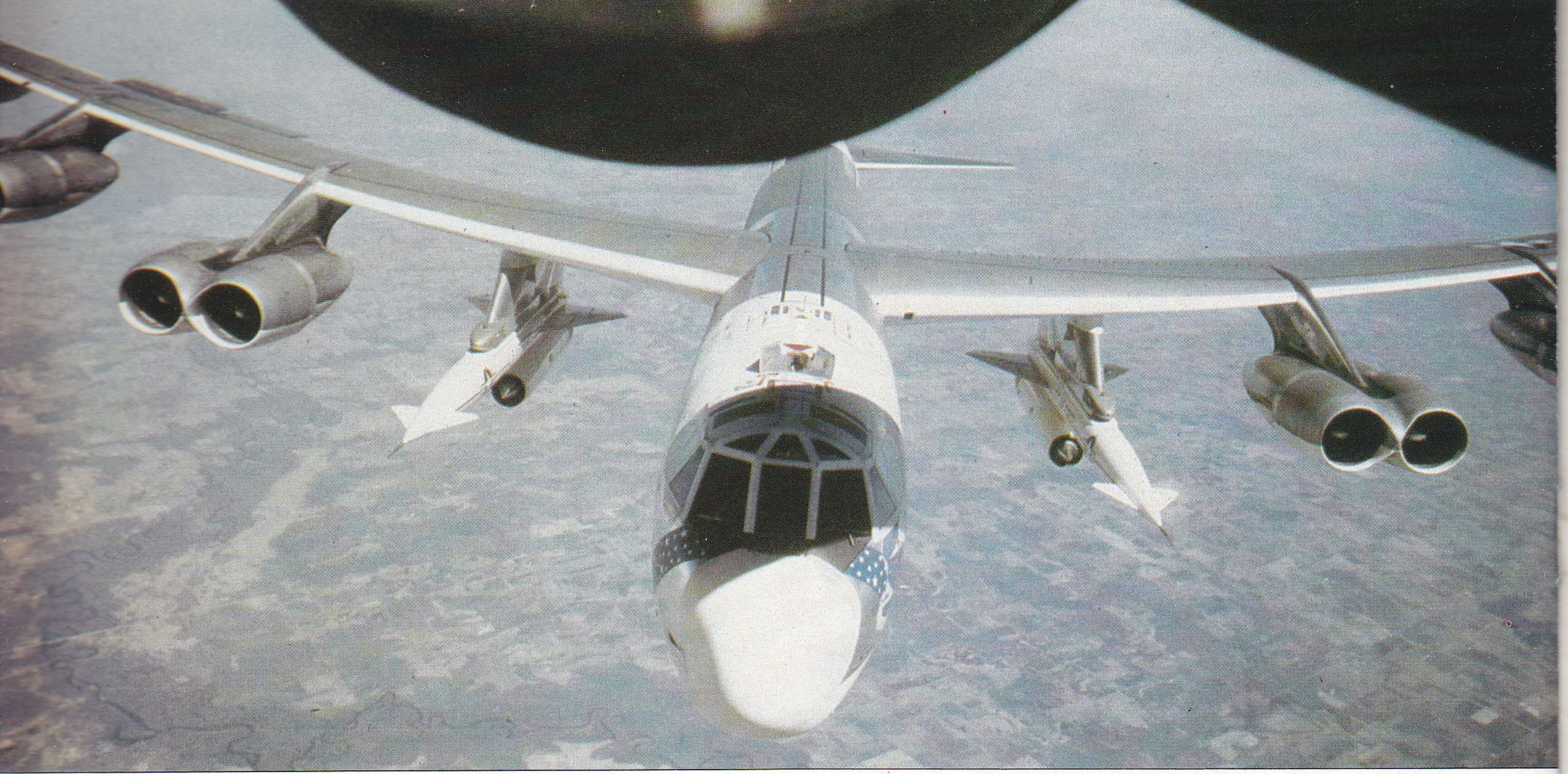


been disastrous had it not been for the fact that the SA-2 'Guideline' missile is probably the oldest and least effective SAM in existence. Whole salvos were spoofed by the B-52s' on-board jammers, decoys, chaff and other countermeasures, and frantic work back in the USA was devoted to adding further EW kits to give improved protection against new guidance waveforms and frequencies. As it was, 15 bombers were shot down, most by a single unfooled missile which performed as advertised, six B-52s being destroyed on 20 December alone.

It had been a close-run thing. With more missiles or (more to the point) with newer missiles, the North Vietnam defence forces would have been able to inflict unacceptable losses on the B-52 forces; and there was no way a lost bomber could be replaced. At the same time, the strategic damage caused was proving crippling, and 'Linebacker II' finally rounded out the whole ill-starred war in South East Asia with a bomb total of 6,300,000 short tons. This was three times the total for World War II, and Laos appears in *The Guinness Book of Records* as 'the world's most bombed country'.

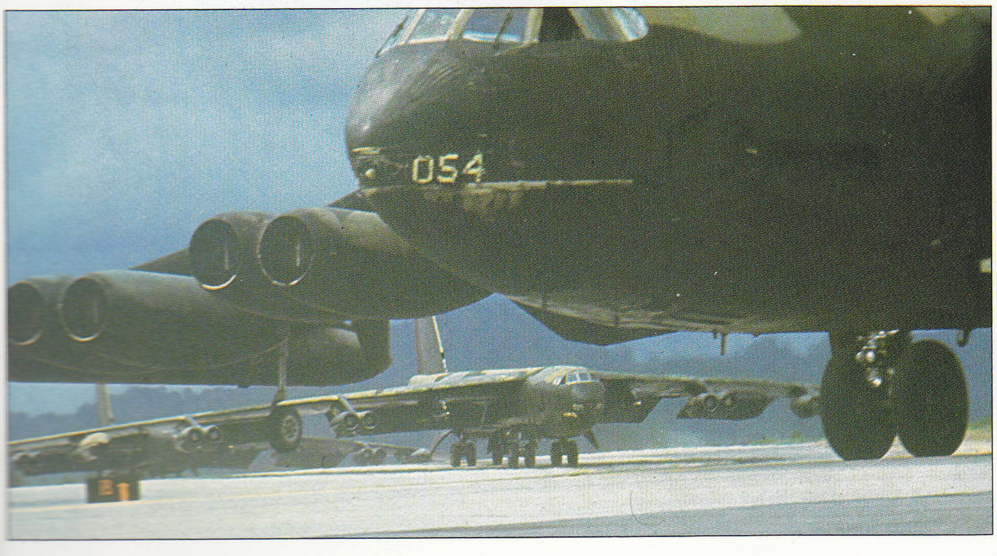
The force dwindles

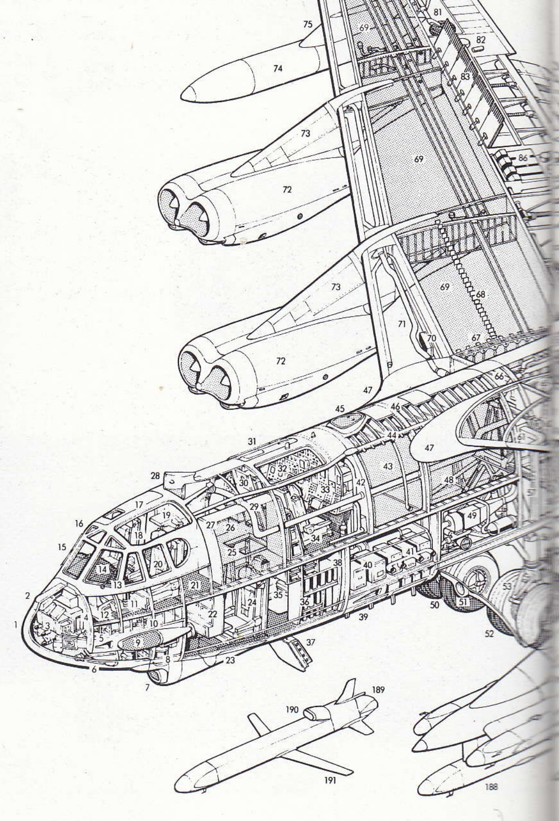
After US forces withdrew from South East Asia the B-52 force was run quickly down to comprise just the B-52G and B-52H, plus a wing of B-52Ds which remained at Guam; the B-52Ds have subsequently been gutted and fitted with completely new digital nav/bombing systems. The B-52G was originally designed to launch two Hound Dog cruise missiles, but these have been withdrawn. From 1971 both the B-52G and B-52H models have been equipped to carry the extremely neat AGM-69 SRAM (Short-Range Attack Missile), which despite its name has a range of up to well over 161 km (100 miles) and can be programmed to fly high, low or complex manoeuvring profiles and, if necessary, approach its target from an unexpected direction at treetop height. SRAM has high accuracy and carries a thermonuclear warhead, and is used by B-52s not only to hit primary targets but also to suppress enemy defence installations.

SRAM's small size means that quite large numbers can be carried on each B-52, and this dramatically increases the number of targets each bomber can attack. Installed in the aft internal bomb bay is a rotary launcher on which eight missiles can be loaded in the same way cartridges are loaded into a revolver. With bomb doors open the SRAMs can be dropped out one by one, each independently targeted. A further 12 missiles can be carried externally

Seen carrying Hound Dog missiles, the B-52H was the last model in production. The TF33 turbofans are visibly larger than the previous J57 turbojets, with much increased thrust.

As well as Andersen AFB, Vietnam B-52s used U-Tapao AFB in Thailand. Here battle-weary B-52Ds taxi out for a much shorter and less tiring mission than those from Guam.





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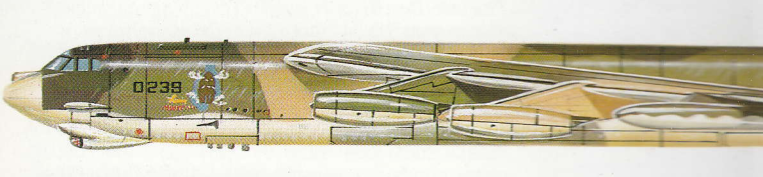
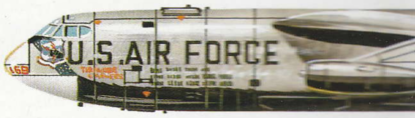
Emblazoned with the winged '2' of the 2nd Air Force (now disbanded), this B-52G is shown as it appeared for the 1974 'Giant Voice' bombing contest.

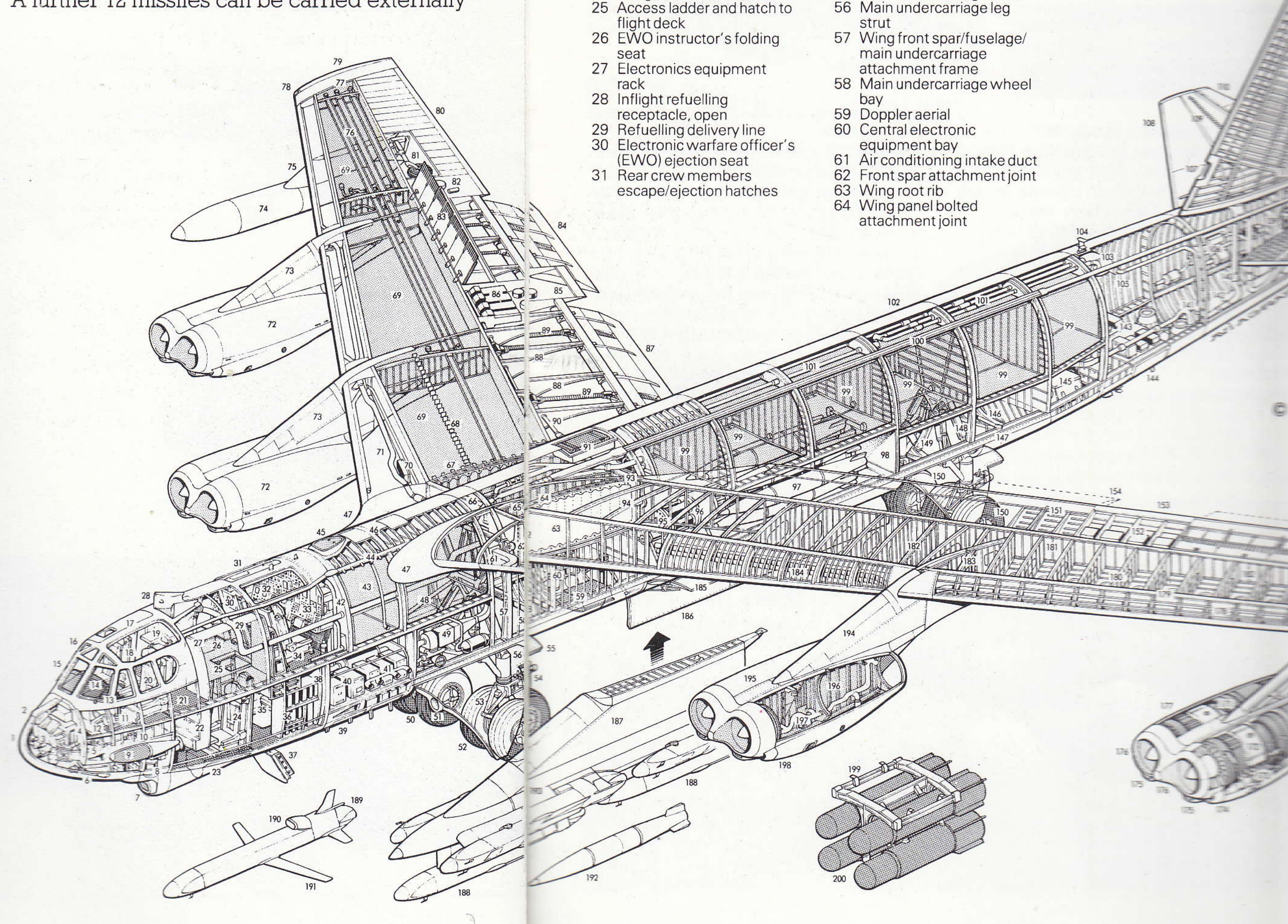


Named 'Thunder Express', this B-52F was a veteran of 68 missions with the 320th Bomber Wing from Guam. The 320th still flies B-52s from Mather AFB, California.

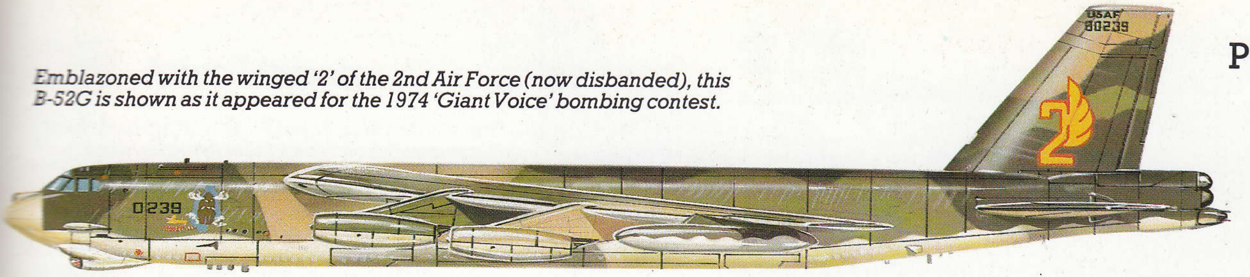


Boeing B-52G Stratofortress cutaway drawing key

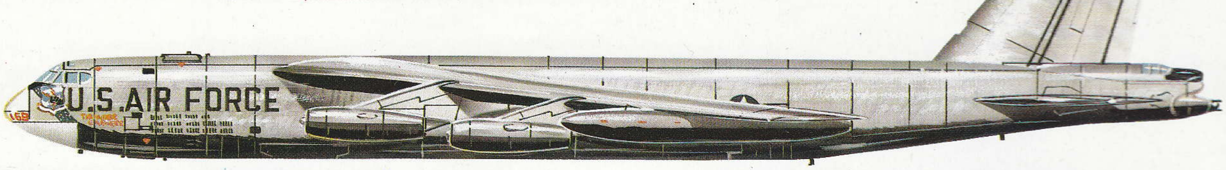
1 Nose radome
2 ALT-28 ECM antenna
3 Electronic countermeasures (ECM) equipment bay
4 Front pressure bulkhead
5 Electronic cooling air intake
6 Bombing radar
7 Low-light television scanner turret (EVS system), infra-red on starboard side
8 Television camera unit
9 ALQ-117 radar warning antenna
10 Underfloor control runs
11 Control column
12 Rudder pedals
13 Windscreen wipers
14 Instrument panel shroud
15 Windscreen panels
16 Cockpit eyebrow windows
17 Cockpit roof escape/ejection hatches
18 Co-pilot's ejection seat
19 Drogue chute container
20 Pilot's ejection seat
21 Flight deck floor level
22 Navigator's instrument console
23 Ventral escape/ejection hatch, port and starboard
24 Radar navigator's downward ejection seat, navigator to starboard
25 Access ladder and hatch to flight deck
26 EWO instructor's folding seat
27 Electronics equipment rack
28 Inflight refuelling receptacle, open
29 Refuelling delivery line
30 Electronic warfare officer's (EWO) ejection seat
31 Rear crew members escape/ejection hatches
32 EWO's instrument panel
33 Gunner's remote control panel
34 Gunner's ejection seat
35 Navigation instructor's folding seat
36 Radio and electronics racks
37 Ventral entry hatch and ladder
38 Lower deck rear pressure bulkhead
39 ECM aerials
40 ECM equipment bay
41 Cooling air ducting
42 Upper deck rear pressure bulkhead
43 Water injection tank, capacity 1,200 US gal (4542 litres)
44 Fuselage upper longeron
45 Astro navigation antenna
46 Tank access hatches
47 Leading edge 'strakelets' fitted to identify cruise missile carriers
48 Forward fuselage fuel tank
49 Air conditioning plant
50 Forward starboard main undercarriage bogie
51 Landing lamp
52 Forward port main undercarriage bogie
53 Torque scissor links
54 Steering jacks
55 Main undercarriage door
56 Main undercarriage leg strut
57 Wing front spar/fuselage/main undercarriage attachment frame
58 Main undercarriage wheel bay
59 Doppler aerial
60 Central electronic equipment bay
61 Air conditioning intake duct
62 Front spar attachment joint
63 Wing root rib
64 Wing panel bolted attachment joint
65 Centre section fuel tank bay
66 Wing centre section carry-through
67 Starboard wing attachment joint
68 Vortex generators
69 Starboard wing integral fuel tank bays; total fuel system capacity (includes external tanks), 48,030 US gal (181813 litres)
70 Engine ignition control unit
71 Bleed air ducting
72 Starboard engine nacelles
73 Nacelle pylons
74 Fixed external fuel tank, capacity 700 US gal (2650 litres)
75 Tank pylon
76 Fuel venting channels
77 Tip surge tank
78 Starboard navigation light
79 Wing tip fairing
80 Fixed portion of trailing edge
81 Starboard outrigger wheel, stowed position
82 Hydraulic equipment bay
83 Roll control spoiler panels, open
84 Outboard single-slotted, Fowler-type flap, down position



Emblazoned with the winged '2' of the 2nd Air Force (now disbanded), this B-52G is shown as it appeared for the 1974 'Giant Voice' bombing contest.

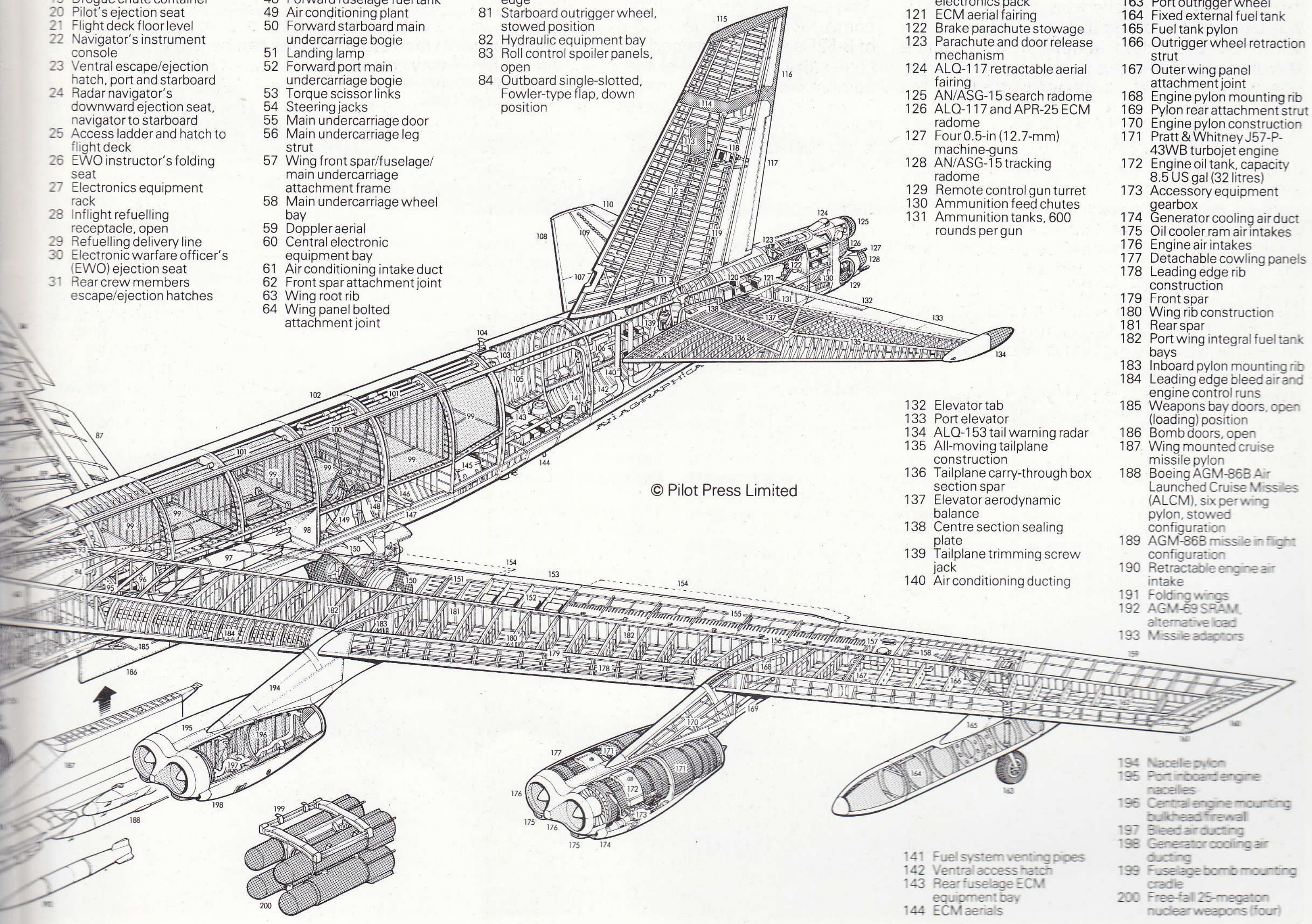


Named 'Thunder Express', this B-52F was a veteran of 68 missions with the 320th Bomber Wing from Guam. The 320th still flies B-52s from Mather AFB, California.



Boeing B-52G Stratofortress cutaway drawing key

1 Nose radome
2 ALT-28 ECM antenna
3 Electronic countermeasures (ECM) equipment bay
4 Front pressure bulkhead
5 Electronic cooling air intake
6 Bombing radar
7 Low-light television scanner turret (EVS system), infra-red on starboard side
8 Television camera unit
9 ALQ-117 radar warning antenna
10 Underfloor control runs
11 Control column
12 Rudder pedals
13 Windscreen wipers
14 Instrument panel shroud
15 Windscreen panels
16 Cockpit eyebrow windows
17 Cockpit roof escape/ejection hatches
18 Co-pilot's ejection seat
19 Drogue chute container
20 Pilot's ejection seat
21 Flight deck floor level
22 Navigator's instrument console
23 Ventral escape/ejection hatch, port and starboard
24 Radar navigator's downward ejection seat, navigator to starboard
25 Access ladder and hatch to flight deck
26 EWO instructor's folding seat
27 Electronics equipment rack
28 Inflight refuelling receptacle, open
29 Refuelling delivery line
30 Electronic warfare officer's (EWO) ejection seat
31 Rear crew members escape/ejection hatches
32 EWO's instrument panel
33 Gunner's remote control panel
34 Gunner's ejection seat
35 Navigation instructor's folding seat
36 Radio and electronics racks
37 Ventral entry hatch and ladder
38 Lower deck rear pressure bulkhead
39 ECM aerials
40 ECM equipment bay
41 Cooling air ducting
42 Upper deck rear pressure bulkhead
43 Water injection tank, capacity 1,200 US gal (4542 litres)
44 Fuselage upper longeron
45 Astro navigation antenna
46 Tank access hatches
47 Leading edge 'strakelets' fitted to identify cruise missile carriers
48 Forward fuselage fuel tank
49 Air conditioning plant
50 Forward starboard main undercarriage bogie
51 Landing lamp
52 Forward port main undercarriage bogie
53 Torque scissor links
54 Steering jacks
55 Main undercarriage door
56 Main undercarriage leg strut
57 Wing front spar/fuselage/main undercarriage attachment frame
58 Main undercarriage wheel bay
59 Doppler aerial
60 Central electronic equipment bay
61 Air conditioning intake duct
62 Front spar attachment joint
63 Wing root rib
64 Wing panel bolted attachment joint
65 Centre section fuel tank bay
66 Wing centre section carry-through
67 Starboard wing attachment joint
68 Vortex generators
69 Starboard wing integral fuel tank bays; total fuel system capacity (includes external tanks), 48,030 US gal (181813 litres)
70 Engine ignition control unit
71 Bleed air ducting
72 Starboard engine nacelles
73 Nacelle pylons
74 Fixed external fuel tank, capacity 700 US gal (2650 litres)
75 Tank pylon
76 Fuel venting channels
77 Tip surge tank
78 Starboard navigation light
79 Wing tip fairing
80 Fixed portion of trailing edge
81 Starboard outrigger wheel, stowed position
82 Hydraulic equipment bay
83 Roll control spoiler panels, open
84 Outboard single-slotted, Fowler-type flap, down position
85 Inboard fixed trailing edge segment
86 Chaff dispensers and flare launchers
87 Inboard single slotted flap, down position
88 Flap guide rails
89 Flap screw jacks
90 Flap drive torque shaft
91 Life raft stowage
92 Wing centre section/longeron ties
93 Central flap drive motor
94 Rear spar attachment joint
95 AGM-69 missile environmental control unit
96 Bomb bay rotary missile launcher
97 AGM-69 SRAM, air to ground missiles
98 Bomb bay rear bulkhead
99 Rear fuselage bag-type fuel tanks
100 Rear fuselage longeron
101 Fuel delivery and transfer piping
102 Fuselage skin panelling
103 Fuselage fuel system surge tank
104 Data link antenna
105 Rear fuselage frame construction
106 Rear equipment bay air conditioning plant
107 Ram air intake
108 Starboard tailplane
109 Vortex generators
110 Starboard elevator
111 Fin spar attachment joint: fin folds to starboard
112 Tailfin rib construction
113 VOR aerial
114 Lightning isolator
115 Fin tip aerial fairing
116 Rudder
117 Rudder tab
118 Hydraulic rudder control jack
119 Rudder aerodynamic balance
120 Rear ECM and fire control electronics pack
121 ECM aerial fairing
122 Brake parachute stowage
123 Parachute and door release mechanism
124 ALQ-117 retractable aerial fairing
125 AN/ASG-15 search radome
126 ALQ-117 and APR-25 ECM radome
127 Four 0.5-in (12.7-mm) machine-guns
128 AN/ASG-15 tracking radome
129 Remote control gun turret
130 Ammunition feed chutes
131 Ammunition tanks, 600 rounds per gun
132 Elevator tab
133 Port elevator
134 ALQ-153 tail warning radar
135 All-moving tailplane construction
136 Tailplane carry-through box section spar
137 Elevator aerodynamic balance
138 Centre section sealing plate
139 Tailplane trimming screw jack
140 Air conditioning ducting
141 Fuel system venting pipes
142 Ventral access hatch
143 Rear fuselage ECM equipment bay
144 ECM aerials
145 Strike camera compartment
146 Rear main undercarriage wheel bay
147 Bomb/wheel bay box section longeron
148 Main undercarriage mounting frame
149 Hydraulic retraction jack
150 Rear main undercarriage bogie units
151 Flap shroud ribs
152 ECM dispensers
153 Fixed portion of trailing edge
154 Port flaps, down position
155 Outboard single slotted flap
156 Port roll control spoiler panels
157 Hydraulic reservoir
158 Outrigger wheel bay
159 Fixed portion of trailing edge
160 Glass-fibre wing tip fairing
161 Port navigation light
162 Outer wing panel integral fuel tank
163 Port outrigger wheel
164 Fixed external fuel tank
165 Fuel tank pylon
166 Outrigger wheel retraction strut
167 Outer wing panel attachment joint
168 Engine pylon mounting rib
169 Pylon rear attachment strut
170 Engine pylon construction
171 Pratt & Whitney J57-P-43WB turbojet engine
172 Engine oil tank, capacity 8.5 US gal (32 litres)
173 Accessory equipment gearbox
174 Generator cooling air duct
175 Oil cooler ram air intakes
176 Engine air intakes
177 Detachable cowling panels
178 Leading edge rib construction
179 Front spar
180 Wing rib construction
181 Rear spar
182 Port wing integral fuel tank bays
183 Inboard pylon mounting rib
184 Leading edge bleed air and engine control runs
185 Weapons bay doors, open (loading) position
186 Bomb doors, open
187 Wing mounted cruise missile pylon
188 Boeing AGM-86B Air Launched Cruise Missiles (ALCM), six per wing pylon, stowed configuration
189 AGM-86B missile in flight configuration
190 Retractable engine air intake
191 Folding wings
192 AGM-69 SRAM, alternative load
193 Missile adaptors
194 Nacelle pylon
195 Port inboard engine nacelles
196 Central engine mounting bulkhead/firewall
197 Bleed air ducting
198 Generator cooling air ducting
199 Fuselage bomb mounting cradle
200 Free-fall 25-megaton nuclear weapons (four)



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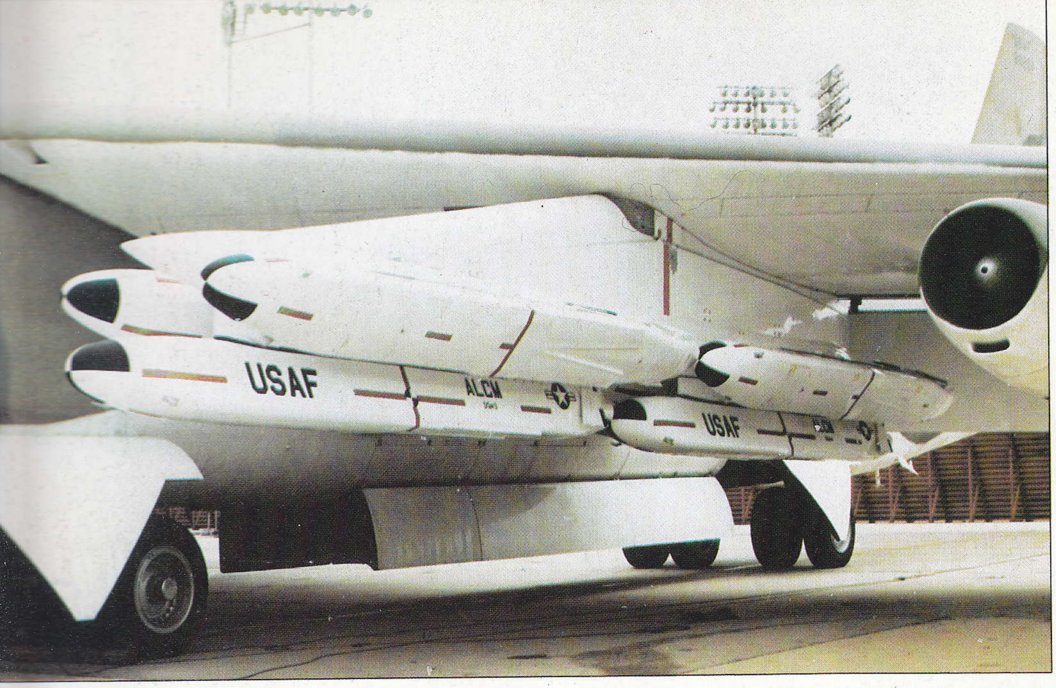


The decision to re-equip B-52s with air-launched cruise missiles will keep them flying for some years yet. They carry six rounds on both wing pylons and a further eight on an internal rotary launcher.

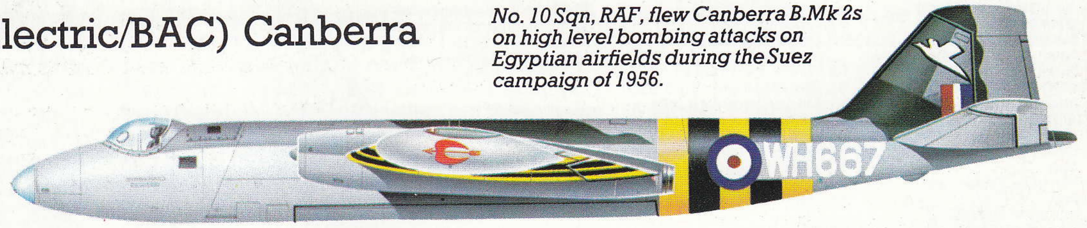
in tandem triplets on long beams attached to the former Hound Dog pylons. Thus each bomber can be targeted against 20 points which can be anywhere within a belt up to 322 km (200 miles) wide along the bomber's route.

Like the earlier B-52D, the B-52G and B-52H continue to be fitted with new avionic systems to improve all-weather navigation, especially at very low level, and offer enhanced protection against modern defence systems. The most visibly obvious add-on was the EVS (Electro-optical Viewing System), which changed the bomber's outline by adding two blisters in the chin position under the nose. The blister on the left contains a TV camera which can be used in low-light conditions, even including a starlit night, while the other blister houses a FLIR (Forward-Looking Infra-Red) sensor, which needs no illumination but 'sees' a black/white scene according to the precise temperature of each item, hotter objects standing out in paler shades or even white. On the flight deck are two large displays looking like TV screens with which the two pilots can see the ground ahead and safely fly at not much above treetop height at night or in bad weather.

Today the 151 active B-52Gs are being further improved, at a cost varying between $573 million and $1 billion per year, with a new OAS (Offensive Avionics System) and equipment to carry the AGM-86B ALCM (Air-Launched Cruise Missile). The original ALCM was roughly the same size as SRAM, but the AGM-86B is longer and so cannot yet be carried internally. Instead each converted bomber has a new pair of external pylons each able to carry six rounds, folded and tightly grouped. Large curved fairings are added to the wing roots so that Soviet satellites can identify the aircraft as a CMC (Cruise-Missile Carrier). Details of the band of heights over which the ALCM can be dropped are classified, but there has to be enough height for the missile to fall free and then unfold its wings, tail and turbojet engine inlet, so that the engine can start and allow the missile to fly to its target independently.

UK

BAe (English Electric/BAC) Canberra



No. 10 Sqn, RAF, flew Canberra B.Mk 2s on high level bombing attacks on Egyptian airfields during the Suez campaign of 1956.

W.E.W. 'Teddy' Petter. former chief designer at Westland, was hired by English Electric in 1945 to give this company, which made thousands of bombers and early jet fighters, the ability to design its own aircraft. The resulting **English Electric Canberra** first flew on 13 May 1949, and astonished everyone by its amazing agility, though its bombload was a respectable 2722 kg (6,000 lb). Entering RAF Bomber Command service in 1951, the Canberra outperformed intercepting fighters in height, speed and manoeuvrability, and gave rise to over 20 basic variants in British service, plus many more for export. The **Canberra B(I).Mk 8** of 1954 introduced a new nose with the nav/bomb-aimer in front and the pilot under a fighter canopy offset to the left; previous marks had mainly been three-seaters with two crew in ejection seats behind the pilot. The radar-equipped **Canberra B.Mk 1** was not put into production, so the first variant was the **Canberra B.Mk 2** with a visual bomb-aiming position in the nose for a third crew member, who had to leave his ejection seat before the high-level bombing run. Normal bombload was tandem triplets of 454-kg (1,000-lb) weapons. The **Canberra B.Mk 6** introduced more powerful engines as well as underwing pylons for two further 454-kg (1,000-lb) bombs, and like some other versions added fuel in the leading edge of the outer wings. All bomber versions were equipped with a visual aiming station in the nose, though the offset-canopy Canberra B(I).Mk 8 and its many derived export versions normally operated at low level and bombs were sometimes released by the pilot in close dive attacks. These tactical models could also be fitted with a removable pack of four 20-mm cannon with well over 2,000 rounds of ammunition. Almost 1,000 Canberras were built, many remaining in worldwide service.

Specification

Canberra B.Mk 6

Type: three-seat light bomber

Powerplant: two 3402-kg (7,500-lb) thrust Rolls-Royce Avon Mk 109 turbojets

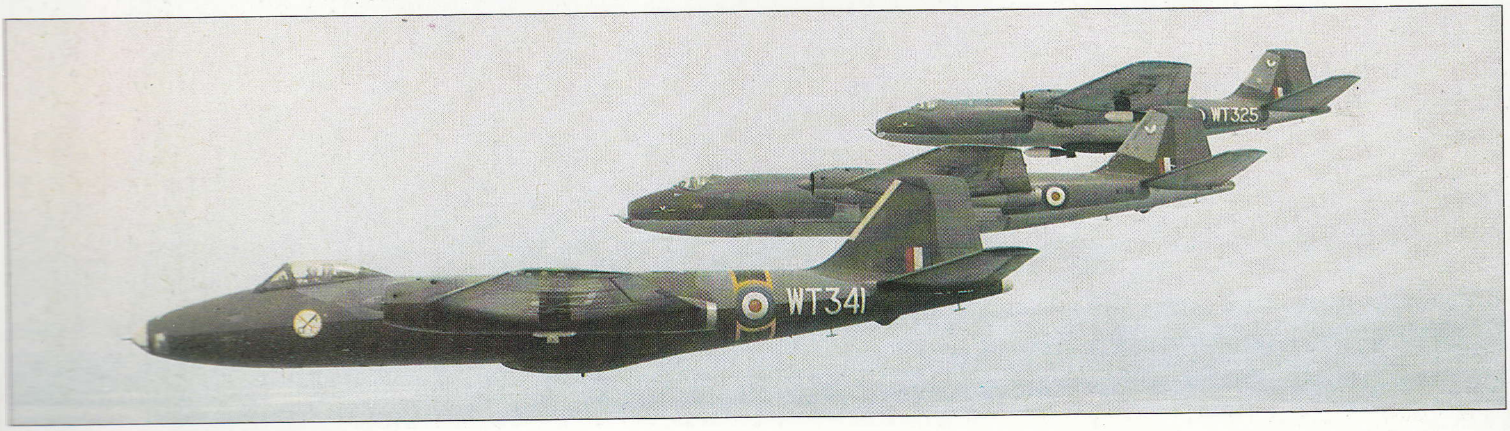
Performance: maximum speed 973 km/h (605 mph) from sea level to 4570 m (15,000 ft); service ceiling 14630 m (48,000 ft); combat radius (high, with full bombload) 1779 km (1,105 miles)

Weights: empty 10099 kg (22,265 lb); maximum take-off 24041 kg (53,000 lb)

Dimensions: span (excluding tiptanks) 19.51 m (64 ft 0 in); length 19.96 m (65 ft 6 in); height 4.75 m (15 ft 7 in); wing area 89.19 m^2 (960.0 sq ft)

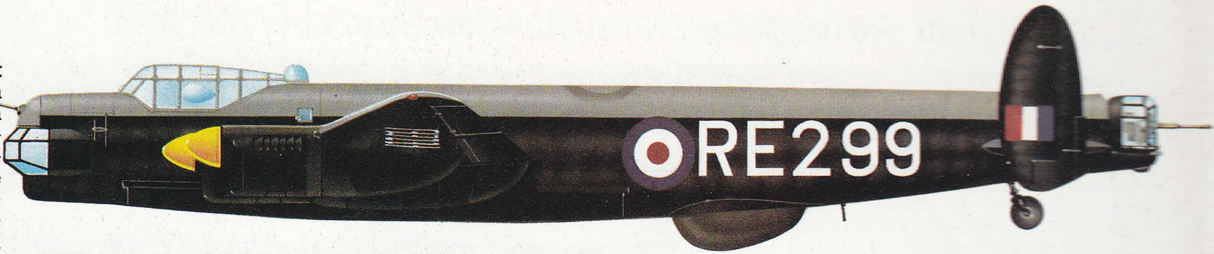
Armament: internal bombload of 2722 kg (6,000 lb) and two underwing pylons for two 454-kg (1,000-lb) bombs, AS.30 missiles or other stores

Canberra B(I).Mk 8 of No. 16 Sqn leads two B(I).Mk 6s of No. 213 Sqn. The difference in cockpits is apparent, and the B(I).Mk 8 carries a four-cannon pack under the fuselage.

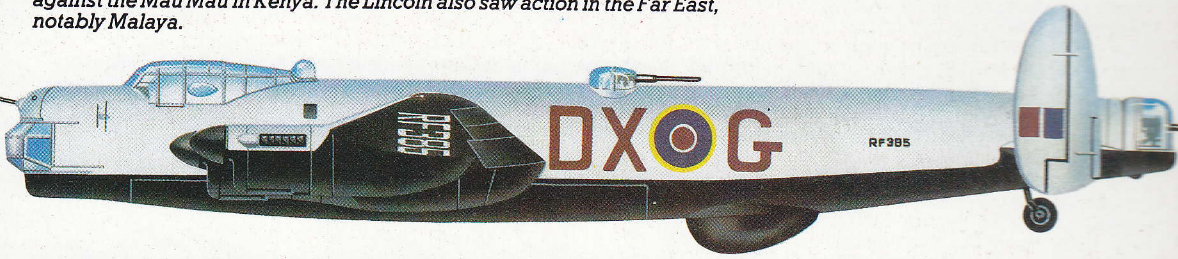


UK

Avro Lincoln



RE299 was a Lincoln B.Mk 2 which served with No. 214 Sqn during operations against the Mau Mau in Kenya. The Lincoln also saw action in the Far East, notably Malaya.

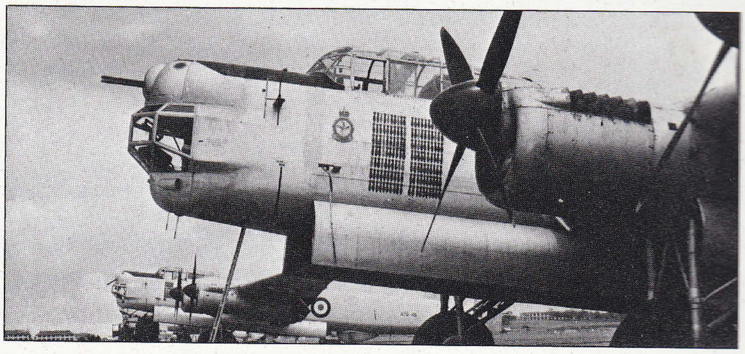


The first unit to fly the Lincoln was No. 57 Sqn, which received three in August 1945. Squadron strength was reached in the following spring. Lincolns saw service overseas, and this example has a Far East (Tiger Force) scheme.

Originally known as the **Lancaster Mk IV**, the **Avro 694 Lincoln** was hardly a new aircraft, though it did have a slightly longer fuselage, extended-span wings, a revised nose, better defensive firepower and the two-stage Merlins previously used in the high-speed Lancaster Mk VI. The prototype flew in June 1944, but the war ended just as No. 57 Sqn, the first recipient, was equipping. Thus the number built was slashed to 528. The one advantage of the Lincoln was that, at a time when the RAF was rapidly running down and suffering from near-zero defence budgets, it could be maintained and operated by anyone familiar with the Lancaster. Thus little investment was needed in order to base it overseas, and many Lincolns saw action in areas of post-war conflict, notably operating against terrorists threatening Malaya in the early 1950s and against the Mau-Mau in Kenya throughout that decade. In these theatres operations were mainly at very low level over forested areas, using the heavy-calibre turret guns and occasionally making runs with GP bombs whenever actual or suspected targets presented themselves. In such missions the perfect view ahead through the flat glass panes of the nose were often helpful in spotting elusive targets, though the size of the Lincoln, whose differences from the Lancaster were aimed at improving high-altitude performance, made it unwieldy for such duties. Before withdrawal in 1963 one detached flight operated in another trouble-spot, Aden.

Specification

Type: seven-seat bomber
Powerplant: four 1,750-hp (1305-kW) Rolls-Royce Merlin 85 liquid-cooled piston engines
Performance: maximum speed 475 km/h (295 mph) at 4570 m (15,000 ft); service ceiling 9295 m (30,500 ft) range with maximum bombload 2366 km (1,470 miles)
Weights: empty 19686 kg (43,400 lb); maximum take-off 34020 kg (75,000 lb)
Dimensions: span 36.58 m (120 ft 0 in); length 23.87 m (78 ft 3½ in); height 5.27 m (17 ft 3½ in); wing area 132.0 m^2 (1,421.0 sq ft)
Armament: nose and tail turrets each with two 12.7-mm (0.5-in) guns, dorsal turret with two 12.7-mm (0.5-in) or two 20-mm guns, and occasionally also one 12.7-mm (0.5-in) ventral hand-aimed gun; bombload up to 6350 kg (14,000 lb)

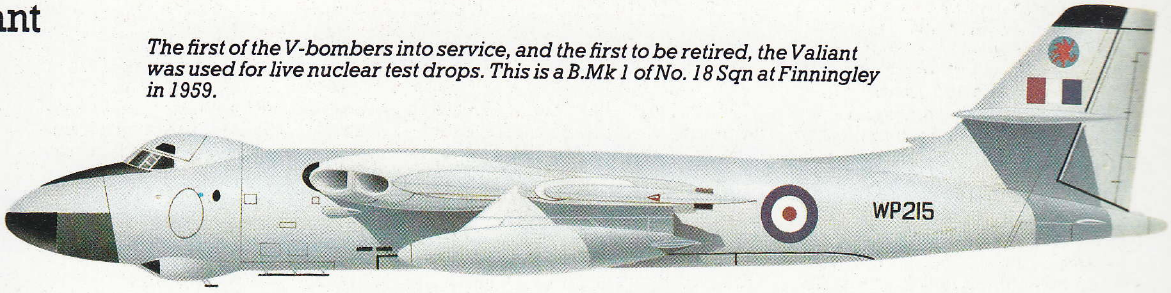


Throughout the Malayan campaign, Avro Lincolns kept up area-bombing attacks on guerrilla positions in the jungle. As well as RAF aircraft, the Royal Australian Air Force took part, whose No. 1 Sqn is pictured.

UK

Vickers Valiant

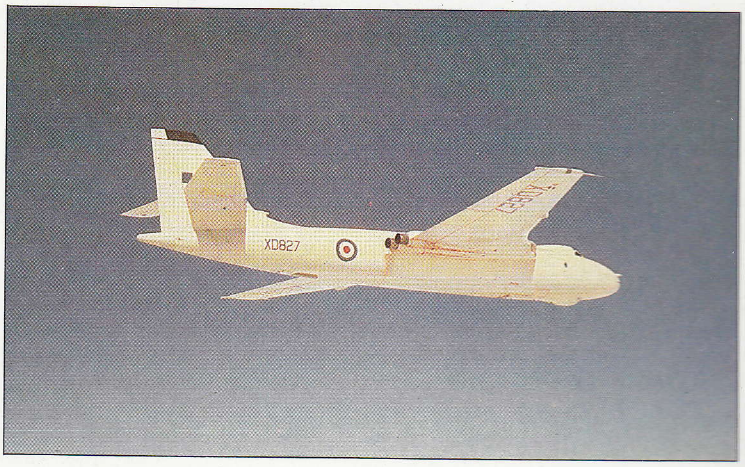
The first of the V-bombers into service, and the first to be retired, the Valiant was used for live nuclear test drops. This is a B.Mk 1 of No. 18 Sqn at Finningley in 1959.



The **Vickers-Armstrongs Type 660 Valiant** first flew on 18 May 1951, and in spite of the fact that two types of so-called V-bomber were already on order it was put into production as well, allegedly as an insurance against 'failure' of the others. Powered by four Avon engines buried in the deep long-chord wing roots, it was a fine aircraft with the crew of five in the pressurized nose and electrically retracting tandem main gears folding outwards like the main units of the wartime B-24. Vickers built 108 including prototypes, and from January 1955 these served with 10 RAF squadrons. At first painted all in anti-flash white, with very pale roundels and serials, they set a high standard in navigation and bombing, though most crews wished to forget their one taste of actual warfare when in late 1956 four squadrons bombed Egyptian targets during the ill-starred Suez campaign. Valiants carried out all of the UK's live air tests of nuclear weapons. There were reconnaissance, tanker and multi-role versions, and from 1963 Valiants were given regular grey and green camouflage and assigned to low-level missions using conventional bombs in support of SACEUR (Supreme Allied Commander, Europe) as a NATO force, though still based in the UK. By this time they were the RAF's only inflight-refuelling tanker force as well, so it was a serious matter when sudden cracking of the airframes forced withdrawal from use in January 1965.

Specification

Valiant B(K.)Mk 1
Type: five-seat bomber and inflight-refuelling tanker
Powerplant: four 4763-kg (10,500-lb) thrust Rolls-Royce Avon 201 turbojets
Performance: maximum speed 912 km/h (567 mph) at 9145 m (30,000 ft); service ceiling 16460 m (54,000 ft); range with reduced bombload 7242 km (4,500 miles)
Weights: span 34.85 m (114 ft 4 in); length (normal long ECM tailcone) 33.00 m (108 ft 3 in); height 9.81 m (32 ft 2 in); wing area 219.44 m^2 (2,362.0 sq ft)
Armament: normal bombload up to four nuclear bombs or 9526 kg (21,000 lb) of conventional bombs; no defensive weapons



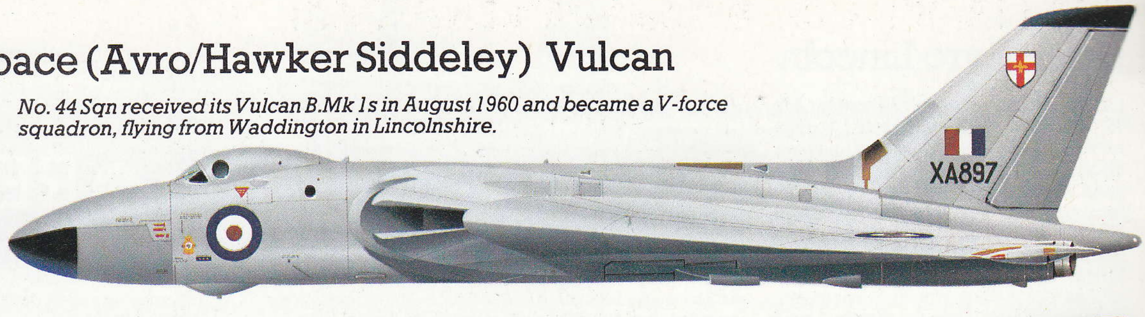
The Vickers Valiant was intended as a stop-gap until the other two V-bombers entered service, but it proved itself a worthy aircraft. Valiants finished their lives as tankers, and were withdrawn after severe airframe cracks were discovered.

UK

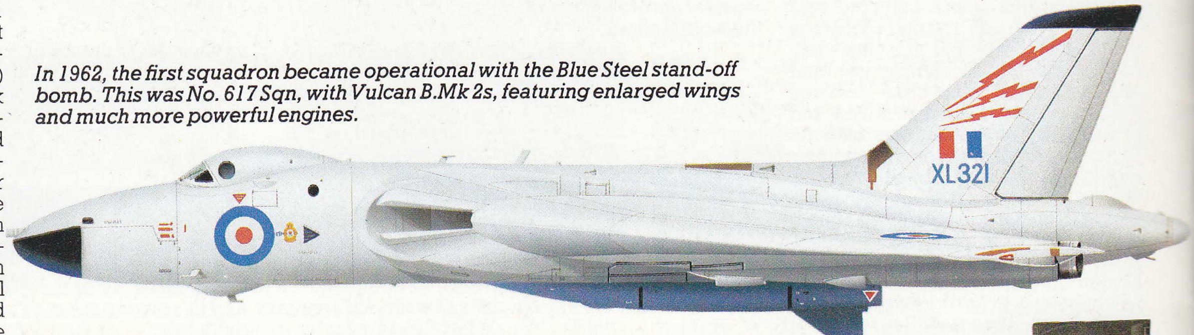
British Aerospace (Avro/Hawker Siddeley) Vulcan

Few aircraft have established such a record as the visually striking **Avro Vulcan**, first flown as an almost perfect white-painted triangle on 30 August 1952 and engaged in actual warfare, in a greatly developed version, 30 years later. The original **Vulcan B.Mk 1**, which entered RAF service in February 1957, had a wing of 330-m^2 (3,554-sq ft) area whose giant inboard sections housed four Bristol Olympus 101 engines of 4990-kg (11,000-lb) thrust each. Later these engines were uprated in stages to 6078-kg (13,400-lb) thrust. After delivering 45 Vulcan B.Mk 1s Avro (later Hawker Siddeley) delivered 89 of the totally re-engineered **Vulcan B.Mk 2** model with a much larger but thinner wing housing and far more powerful versions of the same engine. This mark entered service in July 1960, and at first remained a high-altitude bomber which could launch the large rocket-powered Blue Steel stand-off missile, but by 1966 these had been withdrawn as the entire force had by that time switched to low-level operations using conventional bombs, with a pimple TFR (terrain-following radar) on the nose. Four **Vulcan SR.Mk 2** reconnaissance aircraft served with No. 27 Sqn, and the force was being run down when in April 1982 Argentine forces invaded the Falklands. At once the northern hemisphere was scoured for the inflight-refuelling probes, long since discarded. Several aircraft were converted as tankers, in a crash programme by British Aerospace, while others were urgently equipped with bombs, new navigation systems, flight-refuelling probes, and underwing pylons for ALQ-101 ECM pods and Shrike anti-radar missiles. They bombed Stanley airfield in round trips exceeding 12870 km (8,000 miles), by far the longest in the history of warfare.

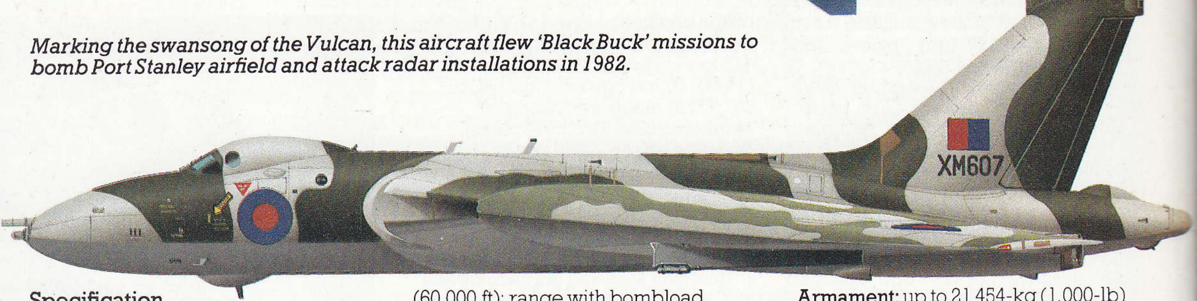
No. 44 Sqn received its Vulcan B.Mk 1s in August 1960 and became a V-force squadron, flying from Waddington in Lincolnshire.



In 1962, the first squadron became operational with the Blue Steel stand-off bomb. This was No. 617 Sqn, with Vulcan B.Mk 2s, featuring enlarged wings and much more powerful engines.



Marking the swansong of the Vulcan, this aircraft flew 'Black Buck' missions to bomb Port Stanley airfield and attack radar installations in 1982.



Specification

Vulcan B.Mk 2A

Type: five-seat bomber

Powerplant: four 9072-kg (20,000-lb) thrust Bristol Siddeley Olympus 301 turbojets

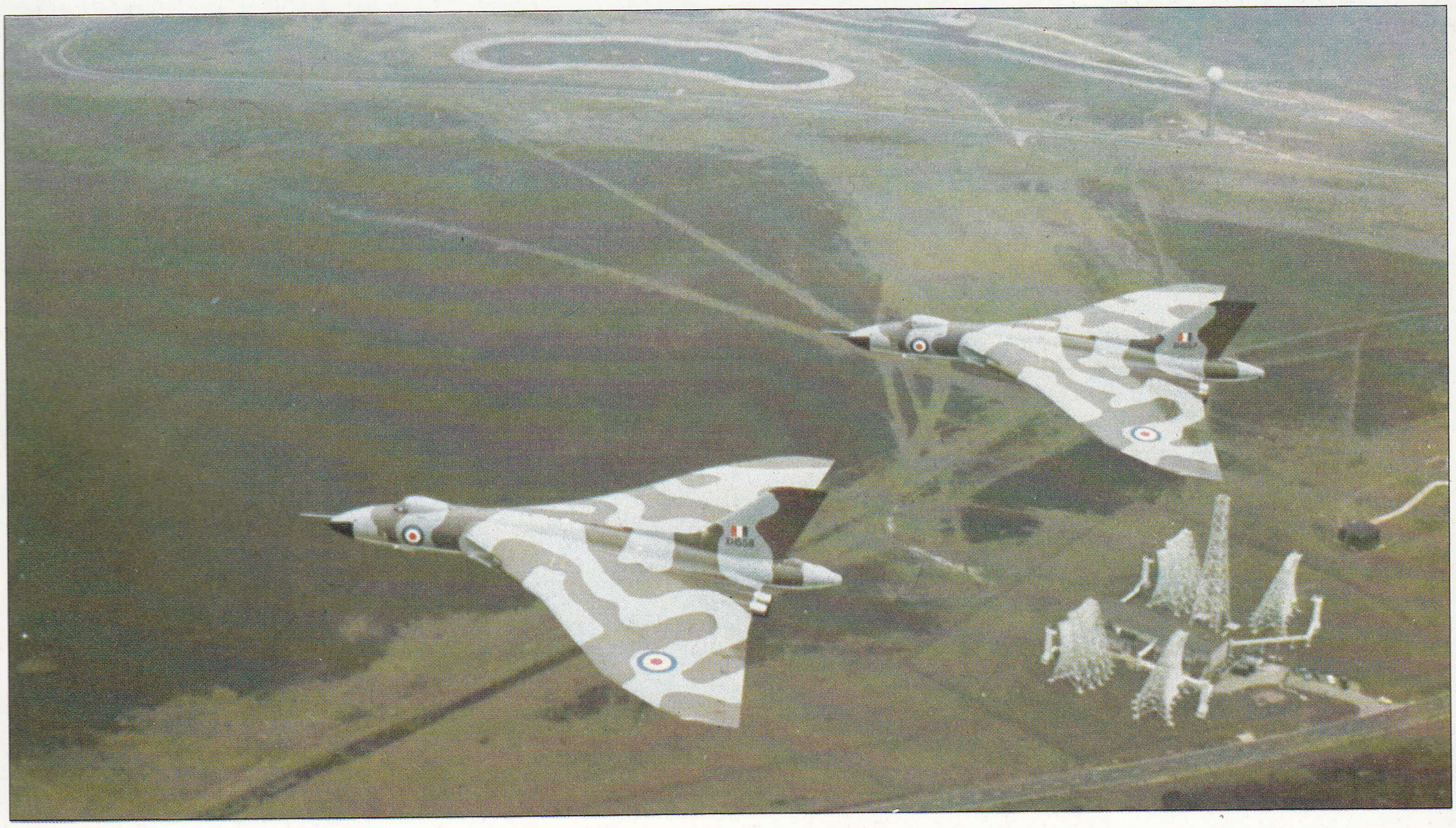
Performance: maximum speed 1043 km/h (648 mph) at 12190 m (40,000 ft); service ceiling 18290 m (60,000 ft); range with bombload 7400 km (4,600 miles)

Weights: empty about 45360 kg (100,000 lb); maximum take-off about 113400 kg (250,000 lb)

Dimensions: span 33.83 m (111 ft 0 in); length (with probe) 32.16 m (105 ft 6 in); height 8.28 m (27 ft 2 in); wing area 368.27 m^2 (3,964.0 sq ft)

Armament: up to 21 454-kg (1,000-lb) bombs; no defensive weapons

By 1966 the RAF Vulcans had been switched to low-level operations. This necessitated a camouflaged scheme instead of the anti-nuclear flash white of the high-altitude V-force days.



Britain's V-bombers

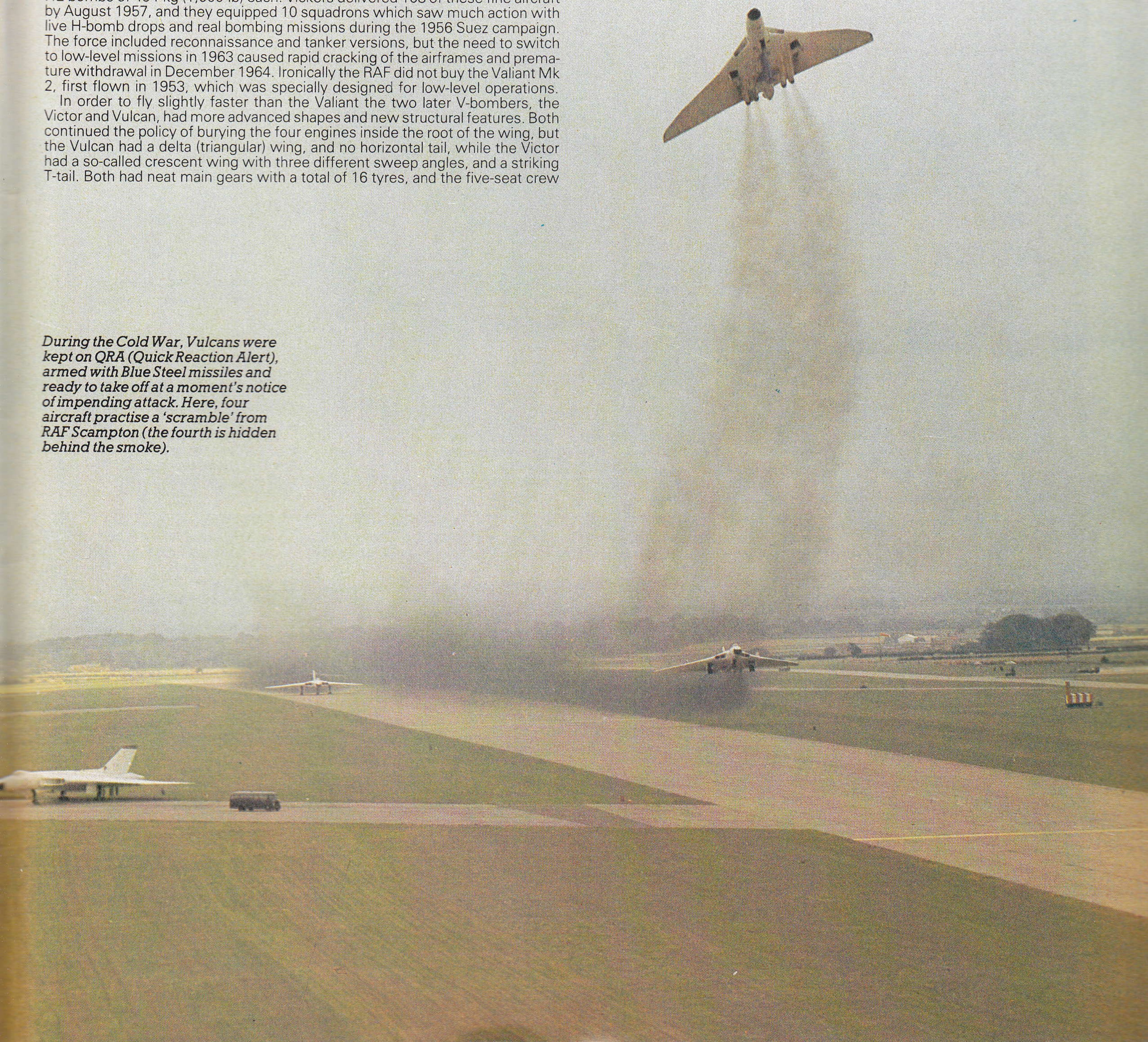
Spurred by Strategic Air Command, Britain's V-force carried that country's deterrent for several years until the submarine force arrived. Accent was on rapid reaction to impending attack, and speed and readiness were second to none.

The UK was amazingly slow in building jet bombers. When it did move it did so very gradually, yet produced four parallel designs all of roughly the same size and power. The Short SA.4 Sperrin was a superb machine but only two were built. The important bombers were the Avro 698, later named Vulcan, and the Handley Page HP.80, later named Victor, which were intended to be of the most advanced design to fly at Mach 0.9 at very great heights. Though both were put into production, yet a third bomber, the Vickers-Armstrongs 660 Valiant, was rushed through as an interim type.

In fact the Valiant was almost as good as the two later bombers, and it reached RAF Bomber Command in January 1955. Powered by four 4559-kg (10,050-lb) thrust Rolls-Royce Avon 204 engines in the wing roots, it had unusual tandem main gears which retracted electrically into the high wing. The crew of five occupied a pressurized capsule in the nose, with a giant radar in its underside, an inflight-refuelling probe (added after delivery in a clumsy afterthought) above and a ventral blister for a visual bombing station. The main weapon bay could house all the UK's nuclear bombs (or the Blue Boar TV-guided bombs) or up to 21 HE bombs of 454-kg (1,000-lb) each. Vickers delivered 108 of these fine aircraft by August 1957, and they equipped 10 squadrons which saw much action with live H-bomb drops and real bombing missions during the 1956 Suez campaign. The force included reconnaissance and tanker versions, but the need to switch to low-level missions in 1963 caused rapid cracking of the airframes and premature withdrawal in December 1964. Ironically the RAF did not buy the Valiant Mk 2, first flown in 1953, which was specially designed for low-level operations.

In order to fly slightly faster than the Valiant the two later V-bombers, the Victor and Vulcan, had more advanced shapes and new structural features. Both continued the policy of burying the four engines inside the root of the wing, but the Vulcan had a delta (triangular) wing, and no horizontal tail, while the Victor had a so-called crescent wing with three different sweep angles, and a striking T-tail. Both had neat main gears with a total of 16 tyres, and the five-seat crew compartments were broadly the same as that of the Valiant. As before, no attempt was made to fit defensive armament, though later high-power jammers and comprehensive radar warning systems were installed. In each case a single large weapon bay was provided, that for the Vulcan being similar to the Valiant's while the Victor's bay was larger and could carry 35 bombs of 454-kg (1,000-lb) size.

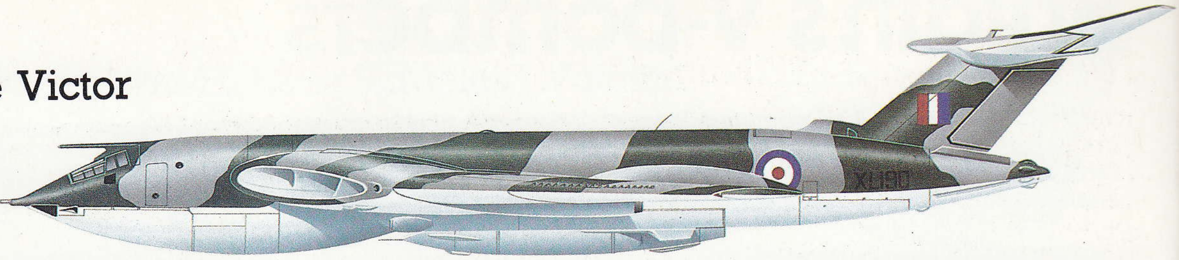
The Vulcan B.Mk 1 had four Bristol Olympus engines each of 4990-kg (11,000-lb) thrust, though over the period 1956 (entry to service) to 1960 these were increased in thrust to 6078 kg (13,400 lb). The corresponding Victor B.Mk 1, which entered service in 1958, had 4990-kg (11,000-lb) Armstrong Siddeley Sapphires. Both aircraft were then redesigned with greater span and much more power, the Vulcan B.Mk 2 having Olympus engines of 9072-kg (20,000-lb) thrust and the Victor B.Mk 2 the Conway turbofan of the same power. There were many internal improvements, and both were designed to carry the big Blue Steel long-range thermonuclear cruise missile, though this was withdrawn when missions changed in 1966 to low level with terrain-following radar. Both aircraft remain in use as RAF tankers.



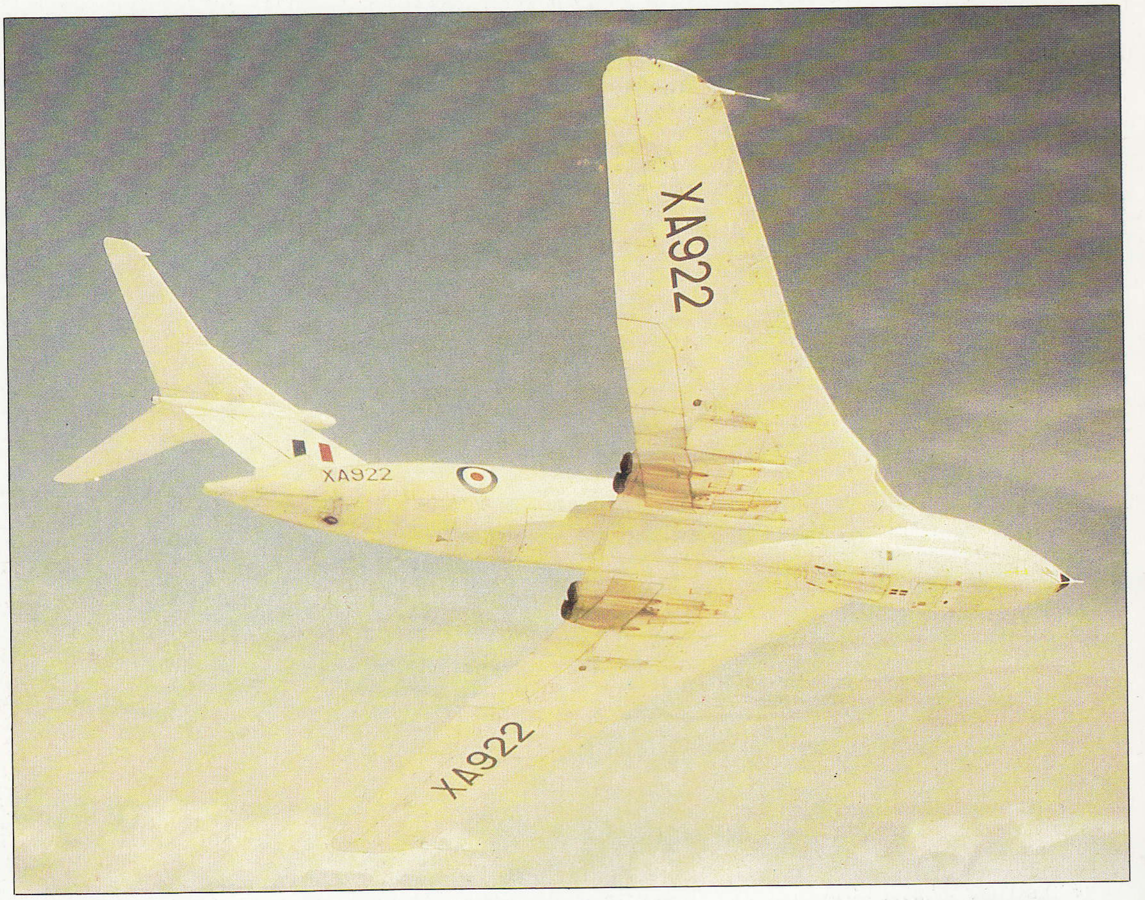
During the Cold War, Vulcans were kept on QRA (Quick Reaction Alert), armed with Blue Steel missiles and ready to take off at a moment's notice of impending attack. Here, four aircraft practise a 'scramble' from RAF Scampton (the fourth is hidden behind the smoke).

UK

Handley Page Victor



Victor B.Mk 2s were operated by No. 139 Sqn from Wittering carrying Blue Steel missiles. However, all Victors had been converted to tankers by 1970.



The Victor as it first appeared. This shot of a B.Mk 1 painted in anti-flash white shows the crescent wing and T-tail to good effect.

Last of the UK's three V-bombers to fly, on 24 December 1952, the **Handley Page Victor** was a striking machine with a then-novel T-tail, very efficient wing with three different degrees of sweepback and high-lift drooping leading-edge flaps, and an unusual sandwich type of construction. As in the other V-bombers, the crew of five was seated in the pressurized nose, and again like the others the problem of crew escape was never solved, ejection seats being provided only for the pilots. The **Victor B.Mk 1** was powered by four 4990-kg (11,000-lb) thrust Armstrong Siddeley (later Bristol Siddeley) Sapphire 201 engines, and this version entered service with No. 10 Sqn in 1958, the total being only 50. Handley Page then emulated Avro in developing a Mk 2 version with greater wingspan, much more powerful engines and totally different equipment and systems. This **Victor B.Mk 2** variant, which entered service in October 1961, was visually distinguished by large chaff dispenser fairings above the rear of the wings which increased speed by postponing Mach drag-rise. Production of this improved machine was continually altered, with cancellations and restorations, but in the end only 34 were built. At first they carried Blue Steel rocket-powered stand-off missiles, but these were omitted from nine **Victor SR.Mk 2** reconnaissance aircraft (all conversions). In the late 1960s all Victor B.Mk 1s were converted as tankers, and the same fate overtook surviving Mk 2s in the 1970s, the total reconstruction being carried out by Hawker Siddeley (formerly Avro) at Woodford because Handley Page no longer existed.

Specification

Victor B.Mk 2R
Type: five-seat bomber
Powerplant: four 9344-kg (20,600-lb) thrust Rolls-Royce Conway 201 turbofans
Performance: maximum speed 984 km/h (611 mph) at 12190 m (40,000 ft); service ceiling 17985 m (59,000 ft); range with full bombload 5632 km (3,500 miles)
Weights: empty about 45360 kg (100,000 lb); maximum take-off (K.Mk 2 tanker) 108864 kg (240,000 lb)
Dimensions: span 36.58 m (120 ft 0 in); length 35.05 m (115 ft 0 in); height 9.18 m (30 ft 1¾ in); wing area 241.27 m^2 (2,597.0 sq ft)
Armament: bombload six nuclear bombs or 15876 kg (35,000 lb) of conventional bombs; no defensive weapons

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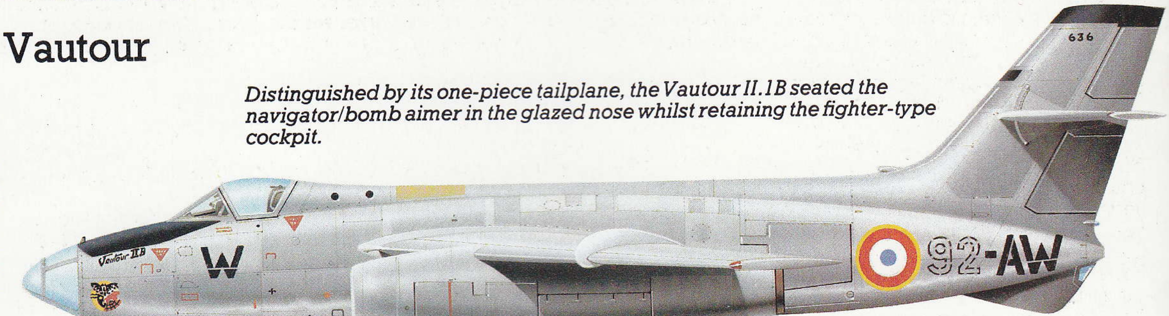
FRANCE

Sud-Aviation Vautour

Distinguished by its one-piece tailplane, the Vautour II.1B seated the navigator/bomb aimer in the glazed nose whilst retaining the fighter-type cockpit.



After World War II the reborn French aircraft industry produced a host of prototypes, but few of these led to viable programmes. An exception was the impressive **SNCASO SO.4050 Vautour** (Vulture), first flown on 16 October 1952. Midway in size between small fighters and jet medium bombers, it had the same layout as the much bigger Boeing B-47, with a mid-high swept wing, underslung engines, a fighter-type nose cockpit and so-called bicycle landing gear. Production took place later in three versions, one of which was a bomber, the **Vautour IIB**. This had a single-seat pilot cockpit similar to that of the **Vautour IIA** attack version, but added a glazed nose for a navigator/bombardier who could use a conventional bombsight. Navigation was mainly by a twin-gyro platform and Doppler radar, and considering the small dimensions of the aircraft an excellent bombload could be carried both internally and externally. The first production aircraft of this sub-type flew on 31 July 1957 and eventully 40 were delivered to equip the Armée de l'Air's 92e Escadre, which was the original operating element of the Commandement des Forces Aériennes Stratégiques (strategic air command), though the chances of even these capable aircraft penetrating heavily defended airspace in the 1960s were not encouraging. In addition the limited range with maximum bombload could not be extended by inflight-refuelling, though this was considered. The Vautour IIB (redesignated **Vautour II.1B** after fitting one-piece tailplanes in the early 1960s) was replaced by the Dassault Mirage IVA from 1965.

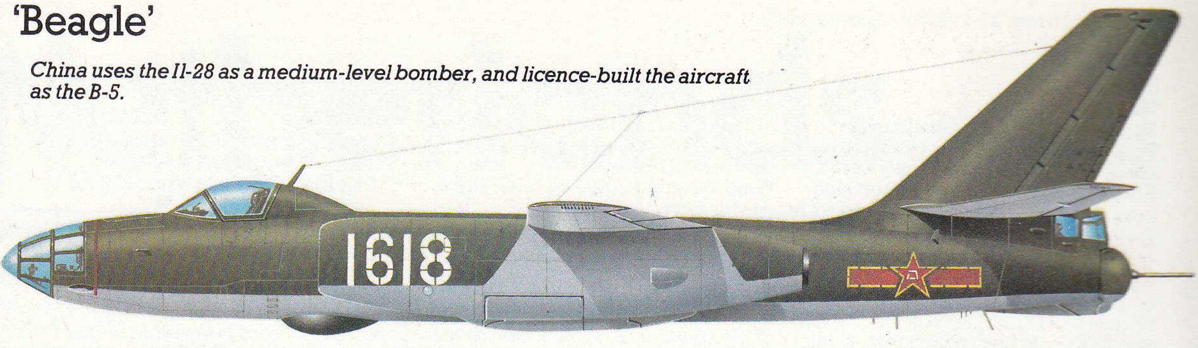
Specification

Type: two-seat bomber
Powerplant: two 3500-kg (7,720-lb) SNECMA Atar 101E-3 turbojets
Performance: maximum speed 1100 km/h (685 mph) at low level and 950 km/h (590 mph) at 12190 m (40,000 ft); radius with maximum bombload 930 km (580 miles); maximum range 5950 km (3,700 miles)
Weights: empty 10470 kg (23,082 lb); maximum take-off 21000 kg (46,300 lb)
Dimensions: span 15.1 m (49 ft 6½ in); length 15.55 m (51 ft 0¼ in); height 4.32 m (14 ft 2 in); wing area 45.00 m^2 (484.4 sq ft)
Armament: internal bay for various bombloads up to six bombs of 340 kg (750 lb); four outer-wing pylons for stores of up to 500 kg (1,102 lb) each; no defensive armament

USSR

Ilyushin Il-28 'Beagle'

The first jet bomber of Soviet design to become known in the West, the **Ilyushin Il-28 'Beagle'** was an outstandingly straightforward machine which, though smaller and in many ways less capable than a Tupolev rival, was unanimously preferred by the bomber crews assigned to evaluate the two types competitively. Accordingly something like 3,000 were built at a rapid rate, followed 20 years later by another 1,500 (designated **H-5** or **Hong-5**) in China. A small number were **Il-28U** trainers, but most are regular light bombers with the pilot on the centreline in a fighter-type cockpit, the navigator/bombardier in the glazed nose and a rear gunner in a separate pressurized turret. Main landing gears house the large wheels lying flat directly under the jetpipes. Unlike the wings, the tail surfaces are swept back to avoid control problems at high speed in dives. The Il-28 proved to be very easy to maintain and delightful to fly, and even today large numbers are still flying in many countries. Except for those in China, most have been modified as targets, meteorological aircraft, and for other second-line duties, but in the period prior to 1970 the Il-28 saw a great deal of action in such places as Nigeria, Egypt, Vietnam, Syria, Yemen, North Korea and Iraq. On most occasions the aircraft was used as a level bomber from medium altitude, typically dropping 250-kg (551-lb) bombs on such targets as airfields and suspected troop concentrations. The **Il-28T** torpedo-bomber was used by the Soviet AV-MF, even though that service also bought a torpedo-bomber based on the Il-28's original Tupolev rival.

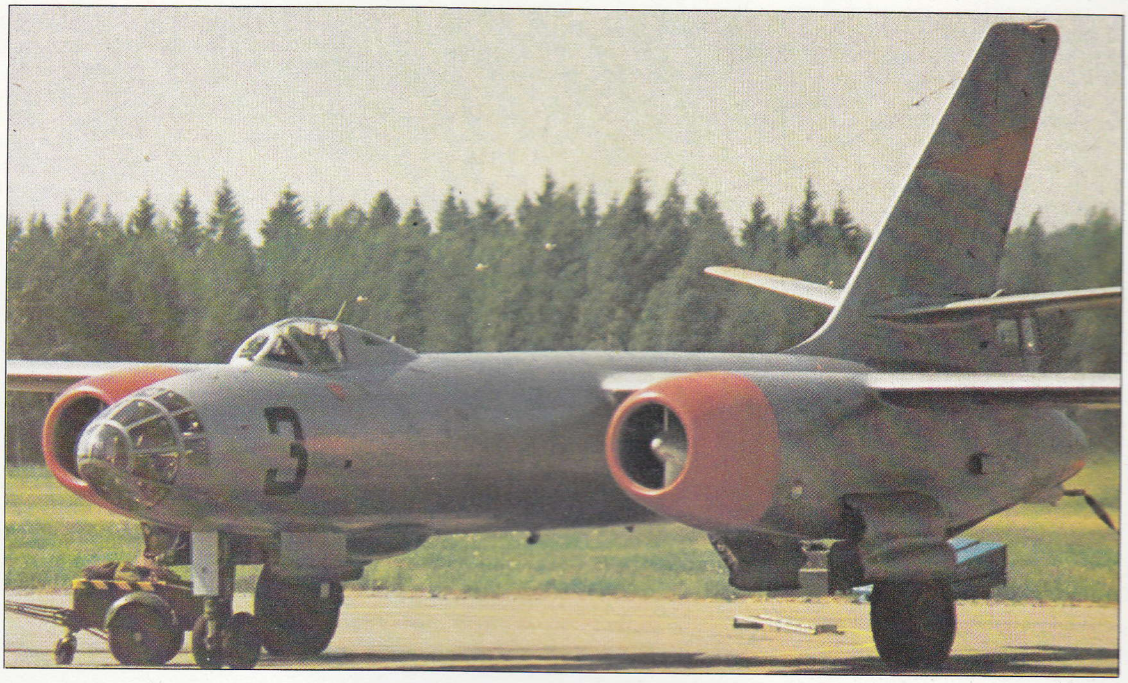


China uses the Il-28 as a medium-level bomber, and licence-built the aircraft as the B-5.

Specification

Type: three-seat light bomber
Powerplant: two 2700-kg (5,952-lb) thrust Klimov VK-1 turbojets
Performance: maximum speed 900 km/h (559 mph) at 4500 m (14,765 ft); service ceiling 12300 m (40,355 ft); range at high altitude with maximum fuel 2180 km (1,355 miles)
Weights: empty 12890 kg (28,417 lb); maximum take-off in original bomber role 21000 kg (46,296 lb)
Dimensions: span excluding tip tanks 21.45 m (70 ft 4½ in); length (typical) 17.65 m (57 ft 10¾ in); height 6.70 m (22 ft 0 in); wing area 60.80 m^2 (654.5 sq ft)
Armament: tail turret with two 23-mm cannon, and in most versions two similar 23-mm guns fixed firing ahead; internal bay for up to 3000 kg (6,614 lb) comprising six FAB-500 bombs each of 500 kg (1,102 lb) or two AV-45-36 torpedoes

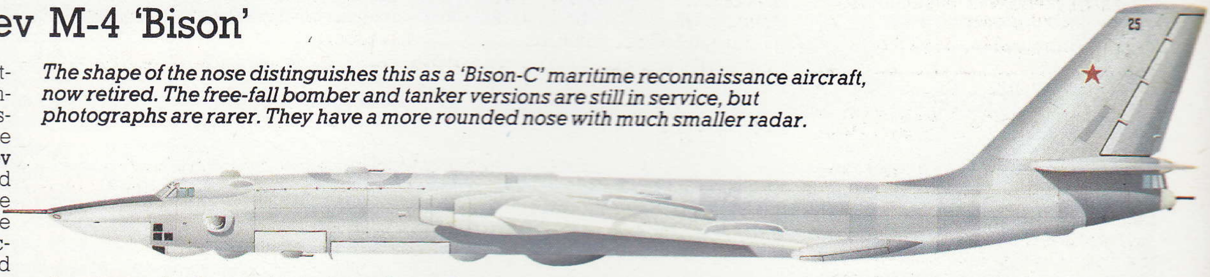
The Il-28 saw much service around the world. The only operators now are China and Finland; the latter uses this aircraft for target towing.



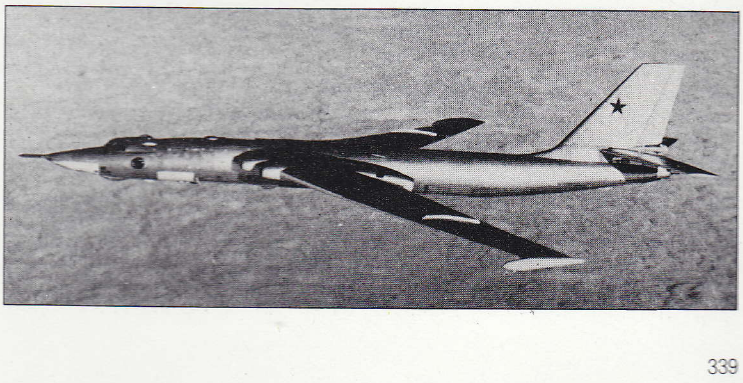
USSR

Myasishchyev M-4 'Bison'

In 1951 V.M. Myasishchyev was directly ordered by Stalin to build a jet bomber to fly long-range strategic missions. The task was then beyond the state of the art, but the **Myasishchyev M-4** (often called the **Mya-4**, and called *Molot,* meaning hammer, by the Soviets, and given the codename **'Bison'** by NATO) proved a most successful aircraft which is still in limited service. Powered by four of the same very large turbojets as the twin-engine Tu-16 'Badger', the M-4 is a very large and impressive machine which on the ground rests on front and rear bogie landing gears, with small stabilizer gears at the wingtips. Between the main gears is the cavernous bomb bay, while all the crew ride in the pressurized nose, apart from the sixth man who mans the tail turret. The first version, a free-fall bomber called **'Bison-A'**, reached regiments of the DA (Long-Range Aviation) in 1956. Altogether about 200 were built. A few were re-engined with much more powerful D-15 turbojets, and many were given different noses as **'Bison-B'** and **'Bison-C'** for mantime reconnaissance purposes. The bomber has a glazed nose for the bomb-aimer, and despite the extremely powerful, and very heavy, defensive armament soon showed great capability. In 1983 it was estimated that 43 remained in active service in the original role. Supporting them are another 30 rebuilt as inflight-refuelling tankers, with many modifications including a large hose drum unit in the rear of the weapon bay. 'Bison-B' was a long-range maritime reconnaissance version, possibly rebuilt from the original bomber, with a 'solid' nose housing a mapping and ship-targeting radar with the refuelling probe above. Numerous other reconnaissance systems were installed. 'Bison-C' was an improved maritime reconnaissance version with an even larger surveillance radar (NATO name 'Puff Ball') in a more pointed nose swollen at the sides and with the refuelling probe at the tip. These flew surveillance and electronic missions for the AV-MF (Naval Air Force).



The shape of the nose distinguishes this as a 'Bison-C' maritime reconnaissance aircraft, now retired. The free-fall bomber and tanker versions are still in service, but photographs are rarer. They have a more rounded nose with much smaller radar.



Another 'Bison-C' shows clearly the housing on the wingtip for the stabilizing wheels, and prominent wing fences.

Specification

'Bison-A'
Type: six-seat strategic bomber
Powerplant: four 9500-kg (20,943-lb) thrust Mikulin RD-3M turbojets
Performance: maximum speed at high altitude 1000 km/h (621 mph); service ceiling at normal loaded weight 17000 m (55,775 ft) or at maximum take-off weight 13000 m (42,650 ft); range 10700 km (6,650 miles)
Weights: empty 70000 kg (154,321 lb); normal loaded 160000 kg (352,734 lb); maximum take-off 210000 kg (462,963 lb)
Dimensions: span 50.48 m (165 ft 7½ in); length (no probe) 47.20 m (154 ft 10 in); height 14.24 m (46 ft 0 in); wing area 309.0 m² (3,326.2 sq ft)
Armament: (as built) 10 23-mm cannon in five power turrets; internal bomb bay for 15000-kg (33,068-lb) bombload

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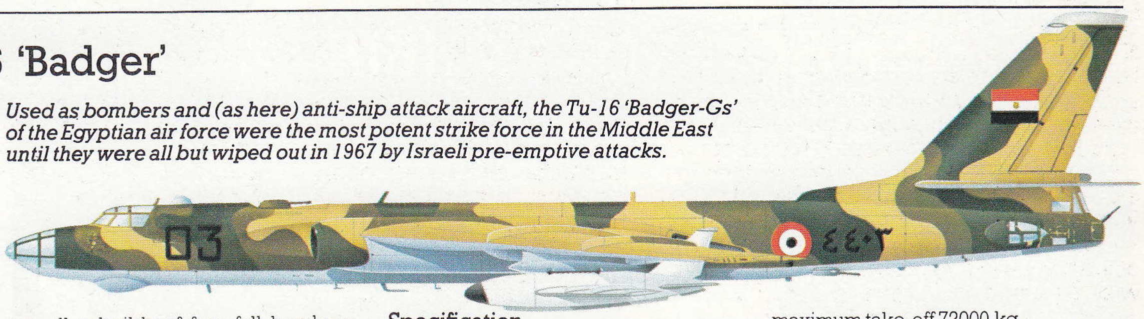
USSR

Tupolev Tu-16 'Badger'

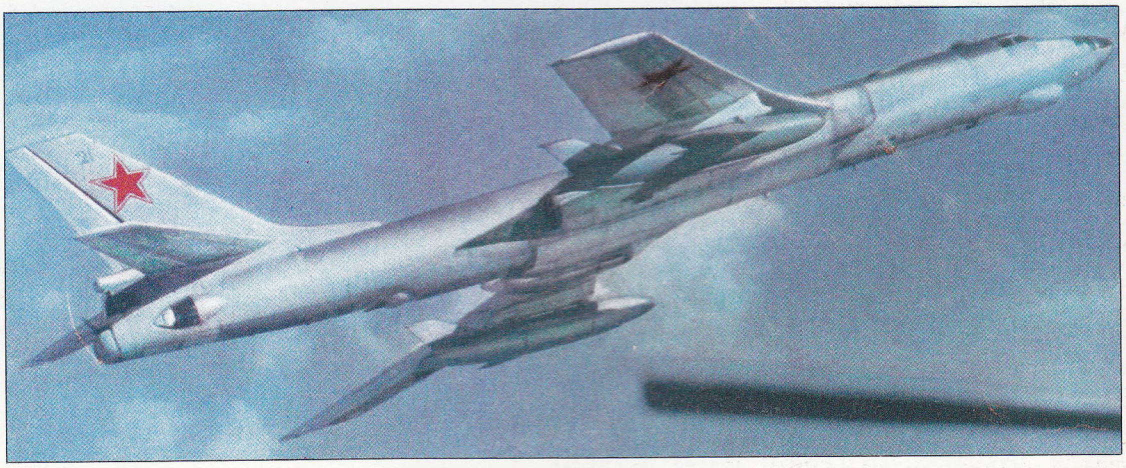


Used as bombers and (as here) anti-ship attack aircraft, the Tu-16 'Badger-Gs' of the Egyptian air force were the most potent strike force in the Middle East until they were all but wiped out in 1967 by Israeli pre-emptive attacks.

Though it was just one of numerous impressive jet bombers flown in the Soviet Union in the post-World War II era, the **Tupolev Tu-16 'Badger'** was the first to become known and impress Western nations, especially when not one but nine aircraft took part in a fly-past on May Day 1954. Though in the same class as the Boeing B-47, this aircraft was notable in having only two engines, mounted on the sides of the fuselage inside the roots of the graceful swept wing. Bogie main landing gears fold backwards into compartments in streamlined fairings on the trailing edge, which almost became a Tupolev trademark. The original bomber, called **'Badger-A'** by NATO, entered service in 1955 and pioneered inflight-refuelling using a looped hose between wingtips. By the 1960s at least 2,000 aircraft in this family had been delivered and today 11 main versions have been identified for use as bombers, missile carriers, anti-ship attack aircraft, reconnaissance aircraft and EW/ECM platforms. The Long-Range Aviation force has almost 600 still in service, while the AV-MF (Naval Aviation) still uses some 300, which continue to be encountered at surprising distances from Soviet territory, indicative of inflight-refuelling and a high degree of reliablity. Flight time on the airframes is typically about 5,000 hours, mostly at low level. There have been many updates of systems and equipment, and the EW/ECM versions are all rebuilds of free-fall bombers. The only model believed to be no longer in active use is **'Badger-C'**, which carried a large air-breathing cruise missile under the fuselage. The important cruise missiles used today are mentioned in the following specification. They are used chiefly in the anti-ship role, together with other Tu-16 aircraft which carry out maritime surveillance and Elint (electronic intelligence) missions in support of the armed variants.

Specification

Type: multi-role bomber/reconnaissance/ECM aircraft with a normal crew of six
Powerplant: two 9500-kg (20,943-lb) thrust Mikulin RD-3M turbojets
Performance: maximum speed 1000 km/h (621 mph) at 6000 m (19,685 ft); service ceiling about 14000 m (45,930 ft); range with 3790-kg (8,355-lb) bombload 4800 km (2,985 miles)
Weights: empty 37200 kg (82,010 lb); maximum take-off 72000 kg (158,730 lb)
Dimensions: span 32.93 m (108 ft 0½ in); length 34.80 m (114 ft 2 in); height 10.80 m (35 ft 6 in); wing area 164.65 m² (1,772.3 sq ft)
Armament: three power turrets each armed with two 23-mm cannon, and usually one 23-mm cannon fixed firing ahead; internal by for up to 9000 kg (19,841 lb) of bombs, or one, two or three cruise missiles of AS-5 or AS-6 types hung externally



The Tu-16 'Badger' is used for many roles including level bombing, missile carriers, tanker, maritime patrol and anti-ship. In this latter duty it carries an AS-5 'Kelt' (or an AS-6) missile under each wing.

USSR

Tupolev Tu-95/Tu-142 'Bear'

When it was first seen, in 1955, the enormous **Tupolev Tu-95 'Bear'** turboprop bomber caused alarm and dismay in the West, because its size betokened truly global range surpassing anything achieved by a jet at that time. Moreover, it lacked nothing in speed, for with swept wings and tail, and remarkable sets of eight-blade contra-rotating propellers, it was as fast as long-range jet bombers. Over the past 30 years these great aircraft have flown in many parts of the world, often in the worst weather, racking up a tremendous record of longevity and reliability. Yet the total production run was fewer than 300. Today the DA (Long-Range Aviation) has an ultra-long-range backbone comprising 113 bombers called **'Bear-A'** and **'Bear-B'** by NATO, the 'Bear-B' version having different radars and a weapon bay modified to carry an enormous cruise missile (known to NATO as 'Kangaroo'). The AV-MF has 75 of various types used for ocean patrol, anti-ship attack, ECM/EW and, in the slightly enlarged **Tu-142** version, called **'Bear-F'** by NATO, anti-submarine warfare. The crew in all versions is accommodated in nose and rear-fuselage pressurized cabins, as well as the pressurized but isolated rear turret, fitted to most versions. Most operational variants have an inflight-refuelling probe on the nose, but even on internal fuel it is possible to fly missions lasting 26 hours. Some models, such as the widely used **'Bear-D'** maritime surveillance aircraft, are packed from nose to tail with radars, navaids, special communications, missile-guidance links and other advanced electronics. On occasion these wide-ranging monsters have been based in friendly countries, such as Cuba, Mozambique and Angola. The even larger and much more powerful swing-wing bomber called 'Blackjack' by NATO is the only visible replacement.

Specification

Tupolev Tu-20/Tu-95 'Bear-A'
Type: strategic bomber with a normal crew of eight
Powerplant: four 14,795-ehp (11033-kW) Kuznetsov NK-12M turboprops
Performance: maximum speed 950 km/h (590 mph) at high alttitude; service ceiling 14000 m (45,930 ft); range with bombload 17500 km (10,875 miles)
Weights: estimated empty 86000 kg (189,595 lb); maximum take-off 154200 kg (339,950 lb)
Dimensions: span 51.10 m (167 ft 7¾ in); length 49.50 m (162 ft 4¾ in); height 12.12 m (39 ft 9 in); wing area 310.50 m² (3,342.3 sq ft)
Armament: two internal bays for a total bombload of 20000 kg (44,092 lb), plus a defensive armament of four (or, with rear dorsal, five) powered turrets each with two 23-mm NR-23 cannon

The Tu-95/Tu-142 'Bear' family displayed phenomenal power and speed when it appeared. This is a 'Bear-B', carrying an AS-3 'Kangaroo' air-to-surface missile.

The Netherlands

Dutch Navy

The Dutch navy has two main bases in The Netherlands, at Vlissingen (Flushing) and Den Helder, with a third in the Netherlands Antilles at Curaçao. The Netherlands-based units are used mainly for anti-submarine warfare, and include a naval air arm with 1,700 personnel and three anti-submarine squadrons (one rotary- and two fixed-wing). The main offensive force operated by the Dutch navy comprises six patrol submarines, supplemented by two guided-missile destroyers which are otherwise allocated to flagship duties. The chief anti-submarine force is made up of 15 frigates and six elderly corvettes. The frigates are multi-capable ships, with advanced sensors and anti-submarine weapons complemented by surface-to-air missiles and, on each ship, container-launchers for eight RGM-84A Harpoon anti-ship missiles. Further strength is to be added during the middle and later 1980s with the commissioning of three further units of the 'Kortenaer' class and up to five 'M' class escort frigates, as well as two 'Walrus' class patrol submarines. The arrival of the surface units will permit the scrapping of the obsolete 'Wolf' class corvettes.

Coastal operations are the responsibility of five large patrol craft and some 15 'Dokkum' class coastal minesweepers/minehunters, the latter class being supplemented by 16 'Van Straelen' class inshore minesweepers. The mine warfare forces are supported by three 'Aggressive' class MCM support vessels, and will be considerably enhanced with the continuing introduction of 15 'Alkmaar' class (Tripartite type) minehunters, the first of which was commissioned in 1982.

Naval personnel number some 16,850 including only 2,000 conscripts, the naval air arm and the marine force. Reserves total 20,000, of which about 9,000 are on immediate recall. The marine force is divided into two amphibious warfare groups, and a reinforced company is allocated to the northern Norway theatre in times of crisis. At sea the Dutch navy is supported by two 'Poolster' class fast combat support ships, current plans calling for the construction of another two of the class in the later 1980s to permit the expansion of the force despite the replacement of the *Poolster* herself.

The navy air arm is based at Valkenburg (fixed-wing aircraft) and at De Kooy (helicopters). The long-range maritime patrol element comprises two squadrons with six Breguet Atlantic (SP-13H) and an eventual 13 Lockheed P-3C Orion aircraft, with two air force-manned Fokker F.27 Maritimes for operations in the Antilles. The rotary-wing force comprises 22 Westland Lynx helicopters, the anti-submarine squadron operating its 17 SH-14B and SH-14C Lynxes from ships, and the search-and-rescue squadron operating its 5 UH-14A Lynxes from De Kooy. Eventual procurement of the Lynx will be 37, the extra aircraft being used to enhance the capabilities of the shipborne ASW force.

Reserves

The Dutch armed forces can in emergencies be boosted by the use of 8,700 para-military police personnel, as well as a home guard of 4,300 armed with infantry weapons and divided into three national sectors. The army reserves of 145,000 are earmarked for the formation of one armoured brigade, two mechanized brigades and one infantry brigade, together with a number of corps troops and territorial brigades for local defence. Deployment of Dutch forces outside The Netherlands amounts to one armoured brigade together with one reconnaissance and one engineer battalions plus support elements in West Germany; one mechanized infantry battalion with the UNIFIL force in the Lebanon; 105 men with the Sinai MFO force in Egypt, and detachments of all three services in the Dutch Antilles.

Dutch Army order of battle

two armoured brigades (one in West Germany)
four mechanized infantry brigades
one Lance missile battalion
three helicopter squadrons (air force crews)
one reconnaissance battalion (in West Germany)
one engineer battalion (in West Germany)
one armoured brigade (reserves)
two mechanized infantry brigades (reserves)
one independent infantry brigade (reserves)

Dutch Air Force order of battle

four strike squadrons
three intercept/strike squadrons
one reconnaissance squadron
one transport squadron
15 SAM squadrons
three operational conversion units
one maritime reconnaissance squadron
one SAR flight

Dutch Navy order of battle

two 'Zwardvis' class patrol submarines
two 'Potvis' class patrol submarines
two 'Dolfijn' class patrol submarines
two 'Walrus' class patrol submarines (on order)
two 'Tromp' class guided-weapon destroyers
nine 'Kortenaer' class frigates (plus three on order)
six 'Van Speijk' class frigates
five 'M' class frigates (on order)
six 'Wolf' class corvettes
31 mine warfare vessels (15 'Dokkum' and 16 'Van Straelen' class)
15 'Alkmaar' class minehunters (for delivery 1982-9)
three 'Aggressive' class mine warfare support ships
five 'Balder' class large patrol craft
10 landing craft
two fixed-wing anti-submarine squadrons
two anti-submarine helicopter squadrons
one SAR helicopter squadron
two amphibious marine combat groups
one mountain/arctic warfare marine company
two 'Poolster' class fast combat support ships

Two 'Kortenaer'-class frigates, HNLMS Callenburgh *(F808) and HNLMS* Banckert *(F810) accompany HNLMS* Tromp *(F801).* Tromp *is one of two of her class acting as flagships for the Royal Netherlands navy.*